JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The South Metropolitan Board.

THE question of the constitution of Gas Companies' Boards was dealt with in the first editorial article last week; the reflections therein being prompted by the changes that the death of Sir George Livesey has occasioned on the Boards of the South Metropolitan and South Suburban Gas Companies, and the reminder that they gave of the firm opinion of the late Chairman that the technical and commercial ramifications of such a business as that of gas production and supply demand that at least two of the Directors should be men of specialized qualification, and that one of them should occupy the chair. With the removal of Sir George, there is on the South Metropolitan Company's Board only one Director fully answering to this description, and that is Mr. Robert Morton, the new Chairman; and, therefore, if the proprietors respect the views of their honoured late Chairman, they will, when called upon shortly, place on the Board a second gas engineer, and one who has a record that proves him worthy of their confidence and of the responsibility. There is one man with pre-eminent qualification for the position; and the existing members of the Board have fully recognized it. It is with extreme pleasure that we are in a position to-day to announce that they have invited Mr. Charles Carpenter, the Chief Engineer of the Company, to allow them to submit his name to the proprietors as a candidate for the vacancy. Whatever claims other candidates may consider they possess for the position, those claims must—in view of his extended official connection with the Company, his position in the gas profession, and his intimacy with Metropolitan and general gas politics—fall far short of those possessed by Mr. Carpenter; and we therefore hope that his consent to candidature will be accompanied by an unopposed election. If so, it will be the best possible ratification by the proprietors of their late Chairman's conceptions and practice in this particular matter.

This is not a personal question only; it is one of policy. If it were merely the former, we would not have done more at this stage than make the simple announcement. In the article last week, there was a hint as to what might happen; and the immediate probable course of events was so obvious that the hint might perhaps have been made in less ambiguous language. Sir George was a shrewd observer of men, and with him time and microscopical examination were not necessary to discover talent. More need not here be said than that it was Sir George who was instrumental in bringing about Mr. Carpenter's accession to the Chief Engineership of the South Metropolitan Company; and we know that the proprietors will be consummating a cherished hope of their late Chairman if, by a unanimous vote, the Chief Engineer is now placed on the Board. That step, if taken (as we have confidence it will be), will, there can be little doubt, be but the prelude to an advance to a more exalted position. In this way will the wise counsel of Sir George be honoured, and, we venture to unhesitatingly assert, with benefit to the proprietors, among whom are the Company's workmen, who hold their present chief in the highest regard and affection. Meanwhile, we also learn that Mr. John Ewart has been appointed Deputy-Chairman for the ensuing twelve months, in accordance with the custom of the Board of conferring the office periodically on the members in rotation.

Gas Companies' Protection Association.

AMONG the past year's activities of the Gas Companies' Protection Association, there are two or three matters that project themselves particularly upon notice in reading the report of the Committee, which was presented, by Mr. H. E. Jones, the Chairman, at the annual meeting last Wednesday. It hardly seems a twelvemonth since that, at the instance of the late Sir George Livesey, the members of the Association assigned to the Executive Committee certain questions for consideration and prosecution that have importance for the industry at large. Mixed with the comprehensiveness of the last half-a-dozen words, there is one regret (which is sharpened by a sentence in the report), in that there are momentous matters frequently occurring in connection with an industry of such corporal ubiquity into which all administrators, though it would be to the interests of their undertakings for them to do so, cannot, or will not, enter. And the posts and bars of the barrier are composed of nothing more substantial than party politics. The subjugation of technical and commercial interests by a hollow loyalty to political party is one of the bad features of the modern municipal management of trading concerns; and if such thraldom could be removed, so much the better would it be for the undertakings.

It is accepted by leaders of industry, no matter what their politics, that the Coal Mines (Eight Hours) Bill will prove an unmitigated evil to the country and to its industries. Those industrial leaders have voiced their fears and experiences, and have stood shoulder to shoulder in this matter—Liberal, Radical, and Conservative alike. But though their trading undertakings will be affected, local authorities have stood aloof from the common dissent with this measure. Why? Because the material interests of their undertakings, ratepayers, consumers, or patrons, must bow to the political susceptibilities of certain of the members, who robe, in their imaginations, their political leaders in the garb of infallibility. That is the sole point. If this matter had not been fathered by the Government, there would have been less reluctance on the part of the rank-and-file of the Liberal and Radical party to have consorted in the overthrow of the measure. A circular sent out by the Association on the subject of the Bill showed, the report says, that practically gas companies were united in opposition to the Bill, but the local authorities, in the main, refrained from expressing an opinion upon it. This illustrates the relative freedom from politics of Boards of Directors and of municipal bodies. On the former, there are men of all political shades of opinion, just as there are on municipal bodies; but they do not allow their political views to stand in the way of the interests of the undertaking when threatened by a proposal that, in the circumstances, if allowed, will give a reverse turn to the wheel of economic progress.

This is a regrettable feature of municipal management. There is, however, in the report one matter dealt with in which the common interest cannot be affected by the austere rule in municipal life of political faith; and that is the real move that has been made by the Association to obtain throughout the country for gas of ordinary standard illuminating powers one method of testing, and that the modern one. A Bill with this object has been drafted in collaboration with the Parliamentary Committee of the Institution of Gas Engineers; copies have been forwarded to the Board of Trade; and Mr. Winston Churchill has promised to receive a deputation on the subject at an early date. This, so far as it goes, is satisfactory; and it is to be hoped that the President of the Board of Trade will see that a uniform system of measuring illuminating power, for comparative, commercial, and scientific purposes, has to support its advantages equal with those claimed for the ordinary standard weights and measures. The matter has now arrived at an interesting stage; and the reply to the deputation, when the President has appointed a time for receiving one, will be awaited with considerable interest. It is hoped there will not be any disappointment in the matter; and there ought not to be, in view of the insistence of Parliament during recent sessions in revising testing clauses in Gas Bills that deviate from the modern model ones. But sessional treatment in a few Bills is a long and tedious route to uniformity; and it is the President of the Board of Trade who has the

most effective power in putting to work next session the machinery to shorten it.

These questions of the Coal Mines (Eight Hours) Bill and the Standard Test-Burner Bill are among the chief features in important work of a general character; but the Association as usual has been during the year the channel of a great deal more useful work (as the report discloses) than this. In complying with the requests for advice on the part of Companies within the membership, the Secretary (Mr. F. E. Cooper) must be accumulating a valuable store of information on diverse matters. The Association, in fact, afford opportunities that are not covered by any of the other organizations in the gas industry; and it is therefore a singular matter for remark that so comparatively few of the Gas Companies of the country avail themselves of the protective and informative offices of the Association. There are in the country 500 statutory gas company undertakings and several hundred non-statutory and privately owned ones; and yet the total number of members of the Association is only 106. The complacency of some gas administrators is marvellous; the disposition to let others sow and labour, but not be absent at the harvesting, is a strong feature of contemporary industrial life. It is hoped that there will be an awakening to the value of unity in sentinel, defensive, and constructive work, and that many more companies will join. No company in the country need fear they will not be in good society in becoming members of the Association, as in the 106 undertakings already associated, there is a bulk of capital represented that is counted by millions and not merely thousands or hundreds of thousands. When therefore the next report is issued, it is hoped to find that the new entries for membership will be numbered by a figure much larger than the eight constituting the enrolment for the past year.

We will not conclude without expressing our pleasure at learning that the Committee are going to give serious attention to the question of how local authorities owning municipal electricity undertakings are allowed to unfairly compete with gas. There are in this relation several anomalies that require correcting in connection with charges for lighting and power, supply regulation, protection in regard to stand-by supplies, assessment in relation to capital, the proper allocation of charges to municipal electrical undertakings, and public lighting. The Committee will find the subject a big one. But it is one that should be attacked on all sides; and we are pleased to see it is going to be done seriously. An instructive table might be compiled by the members supplying certain information referring to the electricity undertakings of their own towns.

Midland Association Meeting.

Boosting district supplies and the sale of gas through slot meters were the principal subjects of discussion at the meeting of the Midland Association of Gas Managers last Thursday. In connection with both questions, views are divergent; and the discussions illustrated over and over again that no universally applicable code of principles to govern practice can be laid down in respect of them, but that purpose and condition must rule in every case. Still, the accumulation of experience and opinion is valuable, as all more or less assist one in making an analysis of a given set of circumstances with the view of arriving at a definite conclusion.

The paper on "High-Pressure Distribution" was by Mr. C. H. Webb; and it recounted experiences that he had had at Stockport, when serving under Mr. Meunier, before going to take charge at Stourbridge. Very contrary views were expressed as to whether Mr. Meunier, from the financial standpoint, having regard to the constant running costs incurred by compression, and the additional plant that has to be maintained, did the best thing in putting down this high-pressure plant for supplying the villages concerned, and whether he would not have done better in at once laying a larger cast-iron main instead of the smaller steel one—incurring a somewhat increased annual charge for interest, but doing away with the running, maintenance, and labour costs associated with the high-pressure plant. In testing the relative financial advantages of a high and a low pressure system, sight must not be lost of the purposes to be served, both immediate and ultimate. In this case, there was in the district a big draft on the mains for about three hours in the afternoon of each working day during a considerable period of the year; and it was this peak load that had to be provided for, and originated consideration of the question of system. Beyond this, Mr. Meunier considered this a good opportunity for commencing a scheme for belting his district with a high-pressure main for meeting the flights in the requirement for gas at the extremities of the Stockport district. Doubtless, Mr. Meunier could make a very strong defence of his choice. Where it is a question merely of supplementing the supply to a particular district either by boosting through a leading main in good condition or by relaying the main with a larger one without compressing plant, then the former plan is generally bound to have sufficient to commend it to cause adoption; where it means a compressing plant *plus* a new main, then financial considerations require to be carefully weighed.

We are not inclined to agree with the suggestion that these high-pressure mains should be taken through back streets. Temporary inconvenience to traffic may produce a perpetual convenience, by providing in the main streets a high-pressure system that can be readily tapped for high-pressure incandescent lamps for street and shop illumination. In this way, the system can be made a revenue-producing adjunct *en route* to the place at which its services are specially required. In one of his asides during the reading of the paper, Mr. Webb mentioned a point that has not been generally observed—that tests made at one of the villages indicated an illuminating power of the gas higher than shown by the works tests. As an example, one instance quoted by him was 15·83 candles at the works; and 16·5 candles at the village. The only explanation advanced for the phenomenon was that the water vapour was squeezed out of the gas by compression.

The slot meter business has such a diversity of aspects that discussion of them under different conditions could be carried to infinity. The paper by Mr. Sidney O. Stephenson stated succinctly the practices at Tipton, and the views of the author founded upon his personal experience. But in the discussion, what may be regarded as the main point of the communication was largely set in the background by the speakers, in their enthusiasm over the more controversial point as to the propriety or otherwise of supplying cookers to slot consumers. Mr. Stephenson argued, and with good cause, that the field for educational work to-day is among the slot consumers; and he is favourable to this work being done by a lady demonstrator. It does not need much argument to show the solid background of reason there is for his submission. The prepayment customers are as a class and individually the smallest patrons; they are the least experienced in the manifold uses of gases, and of the methods by which the highest efficiency can be realized from the gas; and yet *per capita* they have under their protection in many cases a larger amount of the gas undertaking's capital than the general run of ordinary consumers. This educational suggestion is one well worth thinking over and acting upon—at all events, by way of trial.

Mr. Stephenson is of opinion that in the slot-meter business the lighting part is the principal and the mainstay. There is no particular disposition to agree with nor to contradict him here. But we have, particularly latterly, come to the conclusion, from certain experiences in this matter, that, after the slot consumer is shown and given facilities to get the best illuminating duty possible out of his gas, that it is not the lighting part that requires special educational efforts to secure development. It is the use of gas for cooking, boiling, and other purposes that should be popularized to the farthest extent among these consumers, and more so to-day than formerly. Slot-meter consumers—this should be emphasized—are not going to stop at the wasteful flat-flame burners; Mr. Stephenson himself is not letting them. He is now giving them a gas-fitting and an inverted burner for which he charges at present a sort of booking fee of 6d. (which may be discontinued shortly); and the orders are coming in faster than he can keep pace with. This shows the popularity of the latest form of gas lighting among his slot consumers. He thinks that a slot-meter consumer, to be a profitable one, should not use less than a pennyworth of gas a day, which means at Tipton 25 cubic feet. The incandescent burner with which he is supplying his customers looks capable of consuming about 2½ or 3 cubic feet an hour. In the slot consumer's house, it is frequently found that one lighted room suffices in the evening; and therefore, where the gas is only used for lighting, nothing like an average of a pennyworth of gas per day will be used with modern burners. From these premises may be deduced the necessity for the development of the use of gas for other purposes, unless the average profit per consumer is to show a decline. Of course, cookers and other apparatus must not be

placed indiscriminately; but they can be fixed conditionally. There must, too, be some little risk; for the prepayment meter business is essentially of a kind that must be regarded as a whole. But always, as Mr. Fletcher Stevenson puts it, let the fundamental principle of the system remain whatever is done, by adjusting the quantity of gas to the penny, so that the coin covers the consumer's obligations.

Not the least interesting paper in its cardinal parts was that presented by Mr. R. H. Bradbury, in which he described the Beasley continuously recording calorimeter—an instrument which in its somewhat more unrefined form than that which is offered at present was described and illustrated in the "JOURNAL" in July last year. The testing of gas for its calorific power is a matter that has grown in importance as the actual necessity of testing gas for its illuminating power has diminished; but this continuously recording calorimeter that is introduced to us now can only be expected to stand in the same relation to calorific power that the jet photometer does to illuminating power—that is to say, as an approximate indicator of the net calorific quality of the gas, and not as an actual measurer. To bring the continuously recording calorimeter to its present pitch of perfection, the inventors have had to perform a considerable amount of experimental work; but even yet there lurks in one's mind the suspicion that the inventors are not altogether satisfied that their work has defined for them all that is best for such an instrument. We find Mr. Beasley himself saying that "he "thought they could safely say now that *they were getting* the "instrument into a workable form." In the paper, again, the author tells us that "*as a general result*, it may be said "that, so long as the chimney is kept within certain tempera- "ture limits, the average temperature of the chimney above "the surrounding air temperature is a direct measure of the "heat supplied to it." Further an improved meter controller is being designed; and "*it is hoped* that, with this "apparatus, the gas stream will not appreciably alter for "variations of 30 per cent. in the density."

We are not quoting these passages for the purpose of inflicting any injury or to discourage the inventors; but rather to point out to them that they raise certain doubts as to present mechanical and registering reliability, and that it will be no less interesting to gas engineers to have these doubts removed as it will be to the interests of the inventors to be in a position to say that their conquest is complete, and that they can now offer to gas engineers a trustworthy servant for giving them approximately a true running tale of the calorific power of the day's gas output. The paper tells us much about principles; but it stops short of the evidence that practical men ask for in regard to performance. How does the net calorific power continuously recorded by this ingeniously designed instrument compare with the calculated results obtained with the same gas by the aid of the recognized ordinary forms of calorimeter?

Quantity Surveying.

THE new practice has sprung up among contractors in certain trades of insisting upon a signed certificate by a quantity surveyor before submitting a tender. There are arguments both for and against this; but it is quite obvious that the new requirement must lead to two things—one to an increase in the cost of the job by the amount of the fees of a professional quantity surveyor, and the other that attempts will be made by those who have to pay to find means for, whenever it is possible, reducing the expense. Where an engineer of recognized position and competence is engaged on a work and in the preparation of the drawings and specification, the requirement involving the engagement of another professional man and the payment of his fees, appears to be absolutely unnecessary and unjustifiable. There is in mind a case where a gas engineer who had had carefully taken out the quantities for a job, and had personally checked them, was faced by a demand for a certificate from a quantity surveyor, with the result that, to the chagrin of the contractors, the work was not done by contract, but direct. In another instance, a certain large piece of work was executed by contract; a quantity surveyor having taken out the quantities, and signed a certificate. From the same plans and specification, it was desired at a later date to reproduce the work elsewhere; and tenders were invited. The requirement for a signed certificate was insisted on, notwithstanding that there existed one for the former work. The quantity surveyor showed no fastidiousness over applying (for a nominal fee) his signature and a new date to his previously calculated quantities. These are things that are bound to happen. On the other hand, however, the degree of reliance that can be placed upon an engineer's quantities depends upon the engineer; and there are cases where disputes between contractors and engineers over quantity surveys have not been to the benefit of the former in securing the work. Therefore, it is not difficult to appreciate that there are arguments on both sides. Contractors would, of course, find it a somewhat invidious thing to discriminate between engineers in this matter; and thus the feeling in certain trades that a definite practice should be established.

The question has also come to the front in the electrical industry; and professional electrical quantity surveyors are proposed as a corrective of one of the ills from which the industry suffers. Among electrical phenomena are the tremendous variations seen in tenders for wiring installation; it being no uncommon thing for from 50 to 100 per cent. difference to be found between bottom and top tenders. A scheme for a considerable installation for electric light and power is that for the Selfridge stores in Oxford Street; and the sixteen tenders submitted for the work show a difference as between £5261 and £9634—the intermediate prices exhibiting a fairly equally graduated ascent from the lowest figure to the highest. The "Electrical Contractor" and the "Electrical Times" have been looking about for a reason for this. The former favours the view that it is probable the quantity survey was at fault; but its contemporary is disinclined to gracefully accept the theory. On the general question, however, it is thought that there is room for professional electrical quantity surveyors; inasmuch as at present "the work which might be well done by a single expert "is more or less badly done a dozen or twenty times over by "the unfortunate tenderers." Looking down the names of the tenderers for this Selfridge store job, we do not think that their reputations will allow them to sit silently under an indirect aspersion of carelessness or incapacity, or both. But if the reason for the loose tendering is not found in one or both of these, what is it that causes such singular differences in the figures? However, from the point of view of the person who has to pay for a lighting installation, what a lot of expense he is nowadays advised to go to to see that he gets what is wanted, and is not the victim of extortion. There is in addition to the gas or electric engineer, the illuminating engineer, the quantity surveyor, and the contractor. Between them, there ought to be no mistake.

Committing Posterity.

THE ridiculous position into which the London electricity supply question is being forced by a Government that tolerates anything that has its end in municipalization was again accentuated by the proceedings on the London and District Electricity (Power and Bulk) Supply Bill in the House of Commons on Monday last week. The Board of Trade have taken this measure under their wing, though it is a privately promoted one; but they have only accorded their patronage on condition that in the Bill a sop shall be included to appease the appetites of the Progressives of the London County Council, which sop is to take the form of a provision for constituting that body the purchasing authority in the dim and distant future. The instruction to the Committee who will be considering the Bill, to insert such a provision, was duly carried; the Government—notwithstanding that, on their own side of the House, they had against them representatives of Metropolitan Borough Councils owning electricity supply undertakings as well as representatives of extra-Metropolitan districts—having sufficient command of voting power to do practically as they chose in the matter. In connection with this question, the Board of Trade are not looking farther than their noses. All they care about is to get rid of a tiresome question, and leave the future to look after itself. It is not right that they should in any way bind the County Council or the ratepayer of the future, and more particularly in connection with a venture yet unborn, and about the growth of which—as to whether it will be financially robust or a weakling (the prospects are favourable to the latter condition)—no man can yet speak definitely.

The territory the scheme embodied in the Bill covers is three to four times greater than the administrative area of the London County Council, taking in considerable areas of Essex, Kent, Surrey, and Middlesex; and in the area there are 77 local authorities, 42 of which have their own

electricity supply undertakings. Why should the London County Council now have imposed upon them purchase rights in areas in which they have no further jurisdiction? Whatever happens they will have no right to collect a rate-in-aid in the extra-Metropolitan areas if assistance is required; and whatever losses there are will in consequence have to fall upon the ratepaying unfortunates of London. The Government had two amendments suggested to them—one proposing a Board composed of municipal authorities owning electricity undertakings to effect the purchase at the end of the parliamentary span of life of the Company, or the addition of the words to the instruction, "or some other "authority to be appointed by Parliament," providing for an alternative to the County Council. But to no purpose were these amendments submitted. The Government had made up their minds, and had crabbed themselves against all external persuasion. So the matter stands for the moment. There will be strong opposition before the Parliamentary Committee, but, under the circumstances of a despotically used power to what end, other than to put the protest of the times on record? The Government have no care whether or not the ratepayers want to be saddled with these purchase powers; it is sufficient that Mr. Winston Churchill and a majority of his ministerial colleagues have passed their word to the municipal extremists. And this is how we of the present are governed and posterity is committed.

Gas Making in Mond Producers.

We welcome the offer which Mr. Arthur H. Lymn, of the Power Gas Corporation, makes in the concluding paragraph of his letter to us on another page of to-day's "Journal," to supply any information we may require as to Mond gas. Our article on "Gas Making in Mond Producers" on the 13th inst. was mainly directed to showing that a great improvement in the quality of the gas made in these producers was possible if the mode of operating to which the South Staffordshire Mond Gas Company are tied by statutory obligations as to the composition of the gas distributed by them, were abandoned in favour of the procedure outlined in the recent paper by Professor Bone and Mr. Wheeler. Reading the latter paper in conjunction with the previous one by the same authors, we had understood that their investigations were made on a Mond plant with which formerly ammonia recovery had been practised. But Mr. Lymn now states in his letter that "all the Mond plants erected for the "purpose of recovering ammonia are still operating under "those conditions." Are we to understand from him that the plant at Warrington, on which the investigations of Dr. Bone and Mr. Wheeler were made, either is not a Mond plant or that, if it is, it was not originally equipped for ammonia recovery? We should be glad if Mr. Lymn would kindly post us "in actual facts" on this point, as we should much regret having been in error in regard to it.

We have recognized most fully the good results both in yield and in quality of gas obtainable with Mond gas plant when operated according to the later suggestions of Dr. Bone and Mr. Wheeler. But these suggestions are applicable only to producers for private supply, and not to the Mond plant as it is being operated by the South Staffordshire Company for making gas for distribution to consumers in their own district. We do not follow the import of Mr. Lymn's inquiry as to the calorific value of the producer gas made on gas-works, because on these works naturally no coal is directly converted into a producer or semi-water gas as it is in Mond plant. But he is welcome (whatever the purpose of his inquiry may be) to the following figures, which show broadly what existing gas-works plant would give if it were used to produce such a gas—which is not the purpose for which it has been primarily designed. It should afford from a ton of coal approximately 11,000 cubic feet of gas of a calorific value of 615 B.Th.U. per cubic foot; and, after deducting the producer gas consumed in the process, about 105,000 cubic feet of producer gas of a calorific value of 115 B.Th.U. per cubic foot. Thus the ton of coal would afford some 115,000 cubic feet of gas of a calorific value of 160 to 165 B.Th.U. per cubic foot. If the chimney gases or products of combustion of the producer gas consumed in gasifying the ton of coal were added to the gas in question—to bring it on all-fours with ordinary Mond gas—the total volume of gas per ton of coal would be considerably increased, but the calorific value per cubic foot would be lower than the 148 or 150 B.Th.U. assigned to Mond gas. It must be remembered, however, that no fuel is consumed under the boilers in gas-works procedure, and that the separation of the gas made from a ton of coal into three grades—coal gas, coke producer gas, and chimney gas, all of which are, in effect, jumbled together in Mond gas—necessarily involves some expenditure of energy, which is not called for in preparing the mixture of fuel gases and products of combustion known—in South Staffordshire territory, at least—as Mond gas.

The London Junior Association's New Session.

With last week's meetings (reports of which appear in to-day's issue) of the London and Southern District Junior Gas Association and the Western District of the Scottish Association, all the six Junior Associations have commenced their new session; and in every case the beginning has been good, and full of promise of further useful work. Certainly as time goes on there is no abatement discernible in the enthusiasm with which these organizations carry on their work—in fact, the evidence is all in the other direction. Much useful work has already been done; and looking at the present position of the Associations, no one can doubt that much more will be accomplished in the future. Mr. W. J. Liberty, the new President, pointed out in the course of his address to the Southern Juniors, that an important step has been taken by appointing a Permanent Secretary—Mr. A. L. Holton, of Manchester, has been selected for the post—to the Joint Councils of the Associations; for it is in the direction of closer combination between the different organizations that the President foresees a possibility of increased usefulness. In addition to the Presidential Address, the members of the Southern Association were favoured on Friday with a lengthy discourse from Mr. H. E. Jones, which was listened to intently by the large gathering of members. Mr. Jones had much to say on the question of labour that was well worthy of consideration by his hearers; but the address will perhaps be even more valued for the numerous references it contained to Sir George Livesey, whose good qualities and good work for the industry were set forth as only an old and loving friend and ardent admirer could have set them forth. Altogether the meeting was overshadowed by the death of the admitted leader of the gas profession and the undoubted friend of every one connected with it. Sir George's interest in the Association (of which he was a patron) was manifested on more than one occasion; and members showed themselves keenly alive to their loss. With regard to the present flourishing condition of the Association, it is evident that some of the credit for this belongs to Mr. Walter Grafton and Mr. W. Upton. Mr. Grafton was President for several years; and it will be remembered that his services were most appropriately acknowledged on his retirement from the position. For the past two years Mr. Upton has occupied the chair; and now that he has left it, we are glad to see his labours have also received recognition at the hands of the Association, by the presentation of a handsomely-framed vote of thanks.

Trades Unionists and Co-partnership.

Recent adoptions, with full and ready acquiescence by the men, of the principles of co-partnership in the gas industry have supplied the gratifying testimony that the trades unions have completely changed their front in relation to this question. Eighteen years' experience of the system in South London has disclosed such material benefits that the unions find it impossible to discover any adequate or rational excuse for offering resistance to its spread. The altered attitude is promising of greater industrial peace. The wisdom in the matter of the unionists connected with the shipbuilding trade was shown at a meeting on Friday, at which was considered the offer of Sir Christopher Furness to introduce a system of co-partnership into the great ship-building yards of which he is the head at West Hartlepool. There were a hundred delegates present; and they passed a resolution advising the acceptance of the scheme (in accordance with a suggestion of Sir Christopher) for twelve months' trial—the recommendation being subject to the vote of the men this week. There is no objection to the probationary period. It has to be proved to the men that they are not sacrificing liberty, but are consolidating their own material interests in life by becoming sharers in the fortunes of the industry which gives them employment. It is hoped that this fresh adhesion will give further impetus to the co-partnership movement. Sir Christopher's meritorious motive in putting forward this scheme is to end wastage,

and instal thorough efficiency into its place. It is not a local question, it is a national one; and the sooner it is so regarded, the better for the future of the country. Much interest is being taken in Sir Christopher's scheme in the Press; and, in this connection, we are pleased to see that the name of the architect of the successful co-partnership edifice that exists in the gas industry has received due recognition by our daily contemporaries.

THE LATE SIR GEORGE LIVESEY.

We are pleased to be able to intimate that a commission has been placed with Mr. T. W. Pomeroy, A.R.A., for a statue of the late Sir George Livesey, which it is intended to erect in the Central Hall of the Old Kent Road Offices. The execution of the work (which will be in Carrara marble) has been facilitated by the kindness of Lady Livesey, who allowed a cast of the face to be made, under Mr. Pomeroy's direction, before the coffin was finally sealed. The cost of the work will be provided by joint contributions from the Company, its officers, and workmen. Mr. Pomeroy's name may be familiar to some of our readers as the sculptor of the Gladstone statue in the lobby of the House of Commons; and among other monuments he designed the Burns statues at Paisley and Sydney.

The following letter has been sent for publication by direction of the Council of the Institution of Gas Engineers:—

39, Victoria Street, S.W., Oct. 22, 1908.

Sir,—At the meeting of the Council to-day, the question of providing a memorial to the late Sir George Livesey was discussed; and it was unanimously resolved that a suitable memorial is desirable. A Committee, consisting of the President, Vice-Presidents, Mr. Charles Hunt, and the Honorary Secretary, was appointed to consider what steps should be taken to carry out the wishes of the members.

A letter from the Secretary of the Reading Gas Company was read which indicated a desire on the part of that Company to take part in providing such a memorial; and there is no doubt it expressed a very general feeling among all gas undertakings.

The Emergency Committee reported that, on hearing of the death of Sir George Livesey, they had sent, on behalf of the Institution, a letter to Lady Livesey, expressing the deep sympathy of the members with her in her bereavement, and their sense of the great loss the gas industry had sustained.

Walter T. Dunn, Secretary.

The following is a copy of a resolution passed by the Council of the University of Leeds at their meeting on the 21st inst.:—

"The Council record their deep regret at the death of Sir George Livesey, and the sense of loss which the University—in common with so many other undertakings for the public good—has thereby sustained.

"The Council desire to acknowledge the great debt which they owe to Sir George Livesey for the invaluable assistance he rendered in establishing a department of the University relating to the science of fuel, and for the support he enlisted from other members of the industry of which he was the venerated leader.

"The Council desire to convey to Lady Livesey the assurance of their sincere condolence.

"W. F. Husband, Registrar."

As will be seen by the report appearing in another column, the Gas Companies' Protection Association, at their annual meeting last week, passed the following resolution: "That this meeting desires to record its deep sense of the loss the Association has sustained by the death of its Vice-President, Sir George Thomas Livesey, and to acknowledge the invaluable services he ever ungrudgingly rendered to it as well as to the whole gas industry throughout his long and distinguished career, and further respectfully offers its sincere sympathy and condolence to Lady Livesey in her sad bereavement."

Gas Power in Cement Works.—The Swanscombe works of the Associated Portland Cement Manufacturers are now being equipped with some up-to-date machinery. Perhaps the two most interesting evolutions at present going on in these works (says "Engineering Record") are the entirely new washing machinery which has recently been added and is now being driven by a huge gas-engine plant, and the installation for the production of producer gas. This new washing plant, installed in one of the old chalk pits, has mills built on somewhat different lines from those of the Northfleet works. There are three sets of mills, each driven by an Oechelhaeuser gas-engine fixed in the power house. This is a long building as compared with the actual power to be delivered; its length being necessary by the fact that the machinery is operated by horizontal Oechelhaeuser engines, three in number, each having a capacity of 400 to 450 H.P. The gas is brought from producers a quarter-of-a-mile off—of the Mason type, arranged in a row with a continuous coal-bunker over.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 297.)

The week just closed produced no startling feature on the Stock Exchange, and business was very quiet. The general characteristic throughout was a lack of animation and persistent dulness. All eyes were turned towards the East—looking for some sign that might impart a ray of encouragement, and failing to discern it. A slight rally was achieved in mid-week, but not for long. The opening on Monday was very sluggish. Markets were listless, and there was not much disposition to deal either way; but the higher class of securities held steady. Tuesday was at first very dull, but later on became more cheerful, and prices mended somewhat. The better feeling continued on Wednesday. Consols rose $\frac{1}{8}$; the Foreign Bond market was stronger; and the depressed Railways plucked up a bit. But on Thursday weakness showed itself again; the little rally died down; and prices gave way, though not to any large extent. Friday was a bad day, the political tension was irresistible, and realizing was the chief order of the proceedings. Saturday was a thoroughly dull day. Prices drooped, but not excessively; the markets being too inanimate to be able to move much. The Money Market was somewhat firmer, in response to a better inquiry; and discount rates ruled very steady. Business in the Gas Market was about on a level with the preceding week in point of volume; but stocks were not so uniformly firm, and one or two issues were a little easier. This feature, however, need not occasion any wonderment or misgiving in these times when securities of the very highest rank are suffering temporarily from circumstances altogether beyond their control. One of the sufferers was Gaslight and Coke ordinary, though only to the extent of half-a-point. Transactions marked showed a range from 98¼ to 97¼. In the secured issues, the maximum was done at 87½ and 88⅜; the preference at 106; and the debenture at from 85 to 86½. South Metropolitan continued quiet and unchanged, with a few transactions at from 120½ to 121½ (the same as the week before); and the debentures marked 85½. In Commercials, the 4 per cent. changed hands at 106½ and 108½; the 3½ per cent. at 104 and 104½; and the debenture at 83. It is one of the "curiosities" of the market that Commercial debenture stock should be 83 and Gaslight and Coke Debenture Stock 86½. In the Suburban and Provincial group, Alliance and Dublin old was a point easier at 17½, ditto new marked 12¾, Bournemouth "B" 16¾, British 41½ free, Southampton 111 and 111½, Tottenham "B" 106 and 107½, and West Ham 105. In the Continental companies, Imperial was strong at from 183¼ to 186 (a rise of 1½), and European fully-paid was done at 23½ and 24. Among the undertakings of the remoter world, Bombay changed hands at 5¾, Melbourne 5 per cent. at 100½, Primitiva at 6, ditto preference at 5½, and River Plate at 13 and 13¼.

ELECTRICITY SUPPLY MEMORANDA.

Circumstances alter Cases—More Light the Growing Requirement—Development of Metallic Filament Types of Lamp—An Estimate of Lighting Costs with Transformer—The Bulwarks of Confidence.

We are living in an age when daily the truth of the adage that circumstances alter cases is being impressed upon us. Time was, and is now, when possession of arc lamps of reputed high candle power caused the electrician to swear by the superiority of high-power units of light as being best for the illumination of our streets; and time was, but is not so much now, when nothing but small and dim sources of light were considered suitable by the electrician for interior illumination. The electricians find it difficult to subdivide the illumination given by their arc lamps, no matter the type, without loss in efficiency; therefore the old rule stands for street lighting. But, with interior lighting the case is different. The new metallic filament lamps are more efficient; but the difficulty with them has been to get down to the low lighting power per lamp to which faith had been pledged in the days when the carbon filament lamps reigned supreme for interior illumination, unless further complication be introduced into the consumer's lighting system by the use of a transformer or else by running lamps in series. Electricians are remodelling their views, and are beginning to think that perhaps after all consumers will take kindly to sources of higher illumination. Circumstances, it may be repeated, alter cases. The electricians can cover their retreat from the old faith in low illumination sources, so Mr. James Swinburne tells them in the "Electrical Review," by a reference to the past. Mr. Swinburne is not the fanatical enemy of the gas industry that many of his associates of the electrical industry represent themselves to be by their works and sayings; and therefore he is looked upon in the light of a friendly rival. As a matter of fact, he has professionally done good service for the gas industry in the past. However, in the article now before us—the article which shows electricians that the public are amenable to higher light sources—he places himself among the ancients. He says: "I can remember when we had one colza oil-lamp in the drawing-room. It was called a moderator; and the oil had to be wound up every now and then from the base of the lamp. This must have given some 20-candle power; but it threw very little light down on the table or on one's book. If one wanted to read,

he generally had a candle. Most of the candles had thick wicks; and we had snuffers in little silver trays." And then he goes on from this confession of personal antiquity to trace the evolution to higher illumination from that condition of affairs to flat-flame burners and onwards to the era of the incandescent mantle.

Mr. Swinburne thinks that finally we shall have as much light at night as in the day; and he ridicules—notwithstanding the testimony of bank clerks and shopkeepers who work with electric lamps in the depths of the premises in which they are engaged away from Nature's own light—the warning of doctors that too much light is bad for the eyes, and that the glare is very harmful. After all, he argues in his own seductive way, our eyes seem to have been adapted by Nature for use in the day when there is plenty of light, and the sun itself is a fairly dazzling object; and it is not in the least likely that we shall ever have artificial light approaching sunlight. But then we come to the climax in this statement of the case in the words: "At first, no doubt, central stations will suffer, and the consumer will find his bill reduced; but in the long run, he will want more light, and the wire lamp will make the electric light the cheapest as well as the most convenient form of lighting; and it will be a great benefit to the consumer and to the electrical industry." Before the superlative term "cheapest" can be honestly applied to the metallic filament lamp, there is a good bit of intervening space to be covered; but the great thing is that, by reference to the past, the evolution of things illuminating is seen to be towards more light to satisfy human requirement, and in this the electrical industry is to find salvation. The awkward impediment is that while the electrical industry is seeing its way to satisfy this requirement by giving the consumer more illumination for the same expense as obtains with the inefficient carbon filament lamp, the improvements in incandescent gas-burners continue to raise their efficiency per cubic foot of gas consumed, and through the subdivision of lights and the control of each source resting in the hands of the user, the greater illuminating power is realized at an actual reduction in expense.

Meantime, we may congratulate the electrical industry—if they desire to be congratulated—upon the increase in the range of types and patterns of metallic filament lamps, and upon the perseverance that has been shown in pressing towards the goal of the lower illuminating power lamp of the higher efficiency for the higher voltages. There has not been such rapid success in this direction as in the higher illuminating powers. There are metallic filament lamps now made to which illuminating powers of 200, 300, and 400 candle powers are ascribed; but they show no gain in efficiency over the lower power lamps—a 400 candle power lamp, calculated on its performance in the laboratory and when new, taking 440 watts, and it is priced at 25s. This efficiency falls short of that of the arc lamp; but it will, where local authorities exist to whom expense is no object, perhaps find a certain amount of favour. At the other end of the scale, there are metallic filament lamps down to 40-candle power which will run on 200-250 volt circuits; and it is whispered that in the whittling down that is going on, a 32-candle power lamp for such voltage promises to be among us in a few weeks, with an efficiency of 1·25 watts per candle power. For voltages up to 100-110, 25-candle lamps represent the bottom point. And rushlights—nominally 10 to 16 candle power—can be obtained for use on low pressures such as 25 volts. But such low voltages in the ordinary course of things mean transformers. There have now been brought out what are known as candle metallic filament lamps giving the last-named low powers. These are upright lamps; and the lamp globe looks as much like a vertical incandescent mantle as anything we have ever seen. While mentioning these advances (which do not appear to be improving the position of the electricity supply industry very much), it should in fairness be pointed out that tantalum lamps are also now being made for lower candle powers, and that they have, the makers say, been made available for use on alternating currents as well as direct. But meantime cynical electrical engineers are saying that the metallic filament lamp is not a commercial article; that prices for those usable at the ordinary voltages are too high; and that in transit and handling the wreckage is heartbreaking. These cynics may be among those who are finding new customers hard to get, and the lighting load curve showing a decided tendency to flatten.

On the question of the use of transformers, Mr. J. L. Cateaux, Assoc.M.I.E.E., has been writing lately in the "Electrical Review;" and he advocates transforming down so that 25 or 50 volt metallic filament lamps can be applied throughout a house—preferably the former. They can be used in any position, can be obtained in units of 10, 16, and 25 candle power, and their cost is 3s. to 3s. 6d. each. But the most interesting part of his article is an estimate, taking as a base a private house using 50 16-candle power and 24 8-candle power lamps. To fit up this house with carbon filament lamps would cost £3 14s.; while 25-volt metallic filament lamps (he takes the lowest cost of 3s.) would amount to £11 2s., to which £3 must be added for a 1 kilowatt high efficiency auto-transformer—making £14 2s., so showing an extra initial outlay over carbon filament lamps of £10 8s. That is a difference at which many consumers would shy. He assumes that the lamps will only be in use, on an average, one hour a day each throughout the year, which, to say the least, is a rough and ready assumption. On this basis, the annual cost of current at 4½d. per unit for carbon filament lamps would, Mr. Cateaux reckons, be £27; while for metallic filament lamps it would only amount to £7, also allowing merely an average of one hour's use per day per lamp. Then he calculates the use of only 1 watt per candle power per hour; while a consumption of 1¼ watts, experience at the consumers' meter shows, is nearer the correct figure. A 25 per cent. addition should certainly be made to the £7; but, accepting this figure of £7, £2 has to be added for open circuit losses in the high-efficiency transformer, also reckoned at 4½d. per unit. The £9 then exhibits a saving of £18 on the £27 for carbon filament lamps. Therefore, he comes to the conclusion that, deducting the necessary additional outlay of £10 8s. (*i.e.*, the difference between the cost of carbon filament and metallic filament lamps with transformer), in the first year there will be a saving of £7 12s.—that is to say, on his calculations. But supplementing the points already criticized as to probable consumption, it is seen that he has not allowed anything for the cost of conversion from the one system of illumination to the other. Such work is not done for nothing. Passing over the first year, Mr. Cateaux computes that the net annual saving will be £15 10s.; but as the difference between £15 10s. and £18 is only £2 10s., it will be remarked that a renewal per year of about seventeen lamps at 3s. apiece is permitted. There being, in the scheme some 74 lamps in use, a number of them are expected to run on nearly five years before their turn will come for renewal. It is the old electrical tale of a shaving down close to the bone in order to show a good case for electric lighting.

The confidence of electrical engineers in the safety of electricity as a lighting and power agent merits the utmost admiration. It is illustrated in many ways by rules and conditions, countable by the hundred, that it is necessary to observe in making installations. It may be assumed that the Manchester Electrical Exhibition was fitted up with stern resolution that nothing should be left undone that might bring the electrical industry into disrepute. But, as will have been seen by a paragraph at the end of our article on the exhibition last week (p. 187), one of our electrical contemporaries was somewhat alarmed by the ideal conditions that were presented there for a fire. But this week our contemporary makes the reassuring announcement that the exhibition authorities have taken every precaution against an outbreak of fire; and we see the confidence in electricity supply from the danger standpoint well expressed in what follows. The paragraph is headed "*Immunity* from Fire Risks," which is hardly a fitting title. This is what we read under these words: "We understand that *eight hydrants* are available with an ample supply of water and *plenty* of hose, over *sixty sand buckets* are distributed throughout the building, and some *hundreds of fire extinguishers* are charged and ready. There is also a *fire-engine in attendance* close to the building, *with steam always up* and *several firemen at hand night and day*." Plentiful armaments we are told is the most powerful protection against war; and, if this applies to fire, the Manchester Electrical Exhibition should get through this (the final) week without any untoward occurrence. *Apropos* of this, it is seen that the Central Telegraph Office of Brussels had a close shave last Friday morning in escaping from a disaster such as befel the Paris Telephone Office a few weeks since. A fire was originated by a short-circuit, and spread rapidly; but fortunately the outbreak was localized. The damage, however, is described by one correspondent as "important."

PERSONAL.

At the meeting of the Directors of the South Metropolitan Gas Company last Wednesday, Mr. JOHN EWART was elected Deputy-Chairman, in succession to Mr. Robert Morton, who, as announced last week, fills the position rendered vacant by the death of Sir George Livesey.

The new Mayor of Barnstaple is to be Mr. F. W. HUNT, Vice-Chairman of the Barnstaple Gas Company, and a Director of the Barnstaple Water Company. Mr. Hunt is not a member of the Town Council, but he is actively associated with many local institutions in addition to the two Companies already named.

Last Wednesday, Mr. A. SHERRET, the carbonizing foreman at the Windsor Gas-Works, was the recipient of a handsome partly-fitted travelling-bag, on his leaving, after nearly six years' service, to take a similar appointment under the Bahia Gas Company. Mr. Herbert Buckley, the Engineer, on behalf of the officials and workmen, made the presentation, and in doing so wished Mr. Sherret every success in his new sphere. The gift was acknowledged by Mr. Sherret in suitable terms.

Mr. J. PILE, formerly Resident Engineer of the West Molesey station of the Metropolitan Water Board, was last Thursday the recipient of a testimonial from his fellow-employees. A deputation from the works at Ditton and West Molesey waited upon him and presented him with a spirit tantalus, bearing a suitable inscription, and a reading-lamp, which had been subscribed for by the officials and men employed at both the works named. Mr. Pile thanked the deputation, and asked them to convey to the subscribers his appreciation of the kindly feeling displayed towards him.

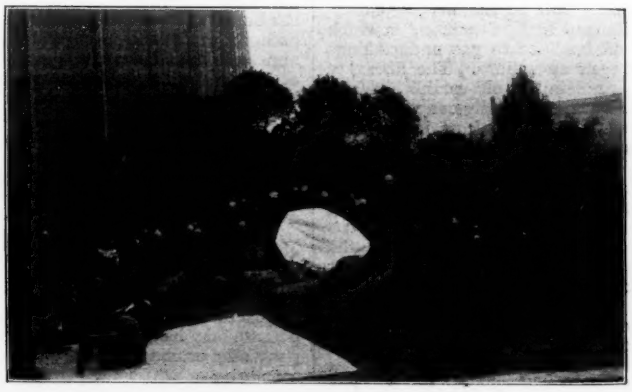
Mr. Duncan Alexander died in Edinburgh last Saturday week, in the 78th year of his age. He was for the long period of 56 years employed in the Edinburgh Gas-Works, and was for about thirty years general foreman.

UNVEILING THE DRORY MEMORIAL STONE AT MARIENDORF.

A SIMPLE but impressive ceremony took place on Friday, the 16th inst., at the Mariendorf (Berlin) works of the Imperial Continental Gas Association, when a memorial stone to the late Mr. Edward Drory was unveiled by the Chairman of the Association, Mr. J. Horsley Palmer.

A large and representative gathering was grouped before the stone on the grass plot to the east of the main street—just within the gates of the works. The near relatives present were: Mrs. Edward Drory, Mr. and Mrs. Charles Drory, Mrs. Leonard Drory, Mr. and Mrs. James Drory, Mr. William Drory, Mr. Alfred Drory, and Dr. Alexander Drory.

In addition to Mr. Horsley Palmer, there were present of the Directors: Mr. Corbet Woodall, Colonel Le Roy-Lewis (with Miss Le Roy-Lewis), Mr. Wilkinson, and Mr. Newton; also Herr Ludwig Delbrück, the Association's representative in Berlin. Practically the whole of the engineering, technical, and commercial staff were present—including Herr E. Körting and Mr. A. F. P. Hayman, as well as members of the Outdoor Department. Deputations of men from each of the works and departments of the Association, as well as from the meter and the stove factories, were also in attendance.



Mr. Horsley Palmer Unveiling the Stone.

Punctually at the appointed time, 10.30 a.m., the proceedings were inaugurated by the singing of "Schäfers Sonntagslied" by the Choral Society of the Mariendorf Gas-Works. It was most impressively rendered; and at its conclusion,

The Chairman stepped forward and commenced his address. He recalled the fact that it was but four years ago that the lamented Mr. Edward Drory had passed away; and he proceeded to extol his sterling qualities, his strong appreciation of family ties, and his unvarying kindness to all whom he met. In this respect, he was forcibly reminded of an incident which occurred when he (the Chairman) was, by chance, following close on the footsteps of his lamented friend when he made a tour of the world. When in Wellington, New Zealand, he had visited the gas-works and mentioned Mr. Drory's name to the Manager there. Immediately the Manager's face lit up with pleasure, as he spoke of how Mr. Drory had, in the course of his visit, helped him with kindly advice and encouragement. This little incident was significant of the whole man, who was ever so ready to help others.

After alluding to the labour Mr. Drory had devoted to the task of superintending the erection of the magnificent works at Mariendorf, whose fine buildings then surrounded them, the Chairman, turning to the stone itself, said it was fitting that on this spot, where the master-mind had plotted out the land, a memorial should be erected to his memory. All heads were bared, as the Chairman withdrew the covering and disclosed the stone—a large block of red granite, on the polished surface of which an inscription was engraved as follows (translated):

Dedicated to Edward Drory
Founder of the Mariendorf Gas-Works
Born, 11th November, 1844
Died, 2nd September, 1904.

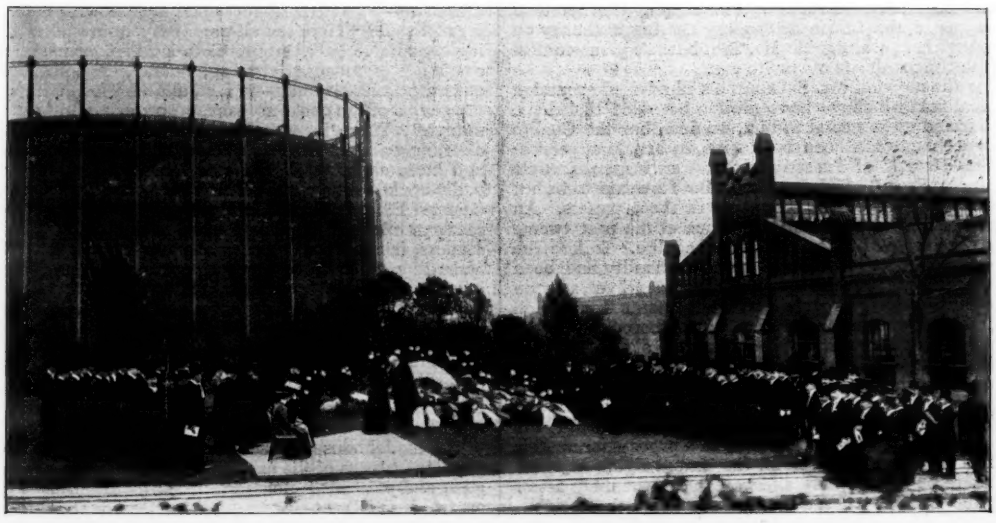
The Chairman concluded by saying that the stone was a simple tribute in honourable recognition of the debt which they all owed to the departed.

Herr Ludwig Delbrück then advanced, and after impressively reading aloud the inscription on the stone, said that it would serve to keep alive the memory of Edward Drory for future generations—recalling how great was the work accomplished by him for the Association, which had paid him a unique tribute (never before accorded) in erecting a memorial to his name. The speaker then told of how Mr. Drory came to Berlin from Vienna in 1896, and with his intuitive grasp of a situation, at once foresaw the necessity of a large modern works, accessible by rail and water, to cope with the great annual increase in the population of Berlin. His restless energy prevailed over all obstacles and difficulties; and in 1901 the first retort of the present Mariendorf Gas-Works was filled. Herr Delbrück paid a warm tribute to the personal character of the deceased, praising his unvarying kindness and self-sacrifice, and, above all, his modesty.

In conclusion, Herr Delbrück reminded those present that they would be best perpetuating the memory of Edward Drory by emulating him in his devotion to the interests of the Imperial Continental Gas Association.

The Chairman then deposited a handsome wreath at the base of the stone, in the name of the Board of the Association; Herr Körting also laying one down for the staff of the Berlin station. This was followed by a long procession of men representing the different works, each depositing a wreath with fitting inscription. The great majority of these men were wearing the silver medal, denoting twenty-five years service with the Association. It was a most impressive sight as the long line moved forward, depositing wreaths, until the whole of the gentle slope at the base of the stone was covered with these floral tokens of affectionate remembrance.

The strains of Beethoven's "Die Ehre Gottes in der Natur," beautifully sung by the Choral Society of the Gitschinerstrasse Works, brought the ceremony to an appropriate conclusion.



The Stone almost Hidden under Memorial Wreaths.

THE NEW COALITE.

THE past week has witnessed a revival of activity on the part of the advertising and publicity departments of the British Coalite Company. The long period of resting in which they have been indulging appears to have been brought to a close, and they have returned to their work. But either because they have not yet shaken off the lethargy which commonly follows prolonged idleness, or because they have lost in perpetuity the freshness and the vigour which characterized their early efforts, the samples to hand of their recent work are disappointing and not worthy of them. It is true they have now received the aid of Mr. James Swinburne, M.Inst.C.E., F.R.S.; but apparently the incongruity of an electrician posing for the nonce as an authority on methods of carbonization has so impressed that arch-humourist that he has become dull and entirely unconvincing. By a singular stroke of irony his article in the Engineering Supplement of "The Times" of Wednesday last, entitled the "Low Temperature Distillation of Coal," appears alongside an article "from an Engineering Correspondent" on "The Metallic Filament Lamp Situation," in which also, curiously enough, is embodied advice to gas undertakings as to how they should conduct their operations. The liberality with which advice is thus dispensed to the old-established and prosperous industry with which we are primarily concerned impels us to ask if electrical engineers would think us impertinent if we proceeded to tell them how by (say) quadrupling the voltage, they could improve the working of electricity supply undertakings. But as there is no reason why the engineering authority on metallic filament lamps should not be equally trustworthy (or untrustworthy) with Mr. James Swinburne in advising upon gas matters, we suggest that these two should each assimilate the other's views before pressing them on the public. Probably neither of these self-imposed advisers expected the gas industry to take him seriously.

Mr. Swinburne, as the sponsor for the new Coalite, points out that only 5000 cubic feet of coalite gas are obtained per ton of coal (against, say, 11,000 cubic feet of ordinary coal gas), but that the coalite gas has a high illuminating and calorific value. The coalite gas, he says, "may be distributed, so that the industry becomes a modified gas manufacture, or it may be used for power purposes." And, again: "The distribution of gas is in the hands of companies and authorities under statutory powers. Instead of putting low temperature retorts in a gas-works, as is being done, for instance, at Plymouth, the gas may be used for power." The engineering authority on metallic filament lamps, after candidly admitting that "gas-mantles of the inverted type still yield a higher degree of illumination than tungsten lamps for the same cost of energy—prices of gas and electricity remaining as they are," goes on to instruct gas companies how, in order that they may compete with electricity on more favourable terms, they can lower the cost of production of their gas. He says: "Now that gas is rarely used for its inherent illuminating capacity, but is almost always employed is conjunction with a mantle where calorific power is alone of consequence, why should not producer gas be served to consumers? In recent years so much attention has been paid to the production of cheap gas for internal-combustion engines, that the gas companies would be in a position to supply gas of a good calorific power at a much cheaper rate than they at present deliver illuminating gas. The candle power of the gas supplied is of no consequence when incandescent mantles are used; and producer or water gas would serve the purpose equally well." Having regard to the fact that coalite gas and producer gas are the very antithesis of one another in respect of illuminating value, calorific power, and applicability for power purposes, the Coalite Publicity Department may really feel aggrieved at the want of consideration shown to them by the Editor of the Engineering Supplement in printing the heretical views on the gas of the future of the engineering authority on metallic filament lamps alongside Mr. Swinburne's pious confession of faith in the prospects of coalite gas.

Leaving for the moment Mr. Swinburne's ill-advised excursion into a technical field which we have always been led to believe was unfamiliar and uncongenial to him, we find that the Coalite Publicity Department has been busy with an article advertisement in "The Times" of Tuesday last, and an inspired article in the "Financial News" of Wednesday. Both are said to be but the precursors of others of the same type in these papers. An explanation is offered of the official reticence of the past twelve months or more in regard to the progress of coalite. It is to the effect that whereas it was thought at first that finality had been reached in the process with the inventor's first plant, yet, as soon as it was working, actively important "improvements" suggested themselves, which it was deemed prudent to test thoroughly before spending money on the erection of works on the old lines, which works "before long would probably become useless on account of the improvements which would eventually have to be made."

We like the candid admission that the original plant may be found as useless for its purpose as we predicted it would be. But the British Coalite Company was floated to work a process for making smokeless fuel by this original plant, the patent rights in which were reported to be unassailable, and were one of the main assets acquired by the Company. We took the view that these rights, whether unassailable or no, were practically worthless, because the same end—*i.e.*, the making of a semi-carbonized fuel such as coalite from coal—could be attained by means of other and more suitable plant and modes of working. And now (to cut a long story short) the Company have adopted "improvements" on their whilom immaculate plant and process, the invention of which constituted such a triumph of genius, and was heralded as one of the greatest blessings which science and art had ever conferred on humanity! But it may be argued that it is open to any inventor to "improve" upon his original invention. Certainly it is; but in regard to the original coalite plant, it was obvious to gas engineers that mere "improvement" would be futile. The only satisfactory thing to be done with it was to discard it *in toto* and start *de novo*. And from Mr. Swinburne's article we gather that this is just what the British Coalite Company have now done. His description of the present plant, while lacking in lucidity—it must be remembered that he is on unfamiliar ground—makes it sufficiently plain that there is little if anything in common between this plant and the Coalite plant of yesteryear. He says the coal "is carbonized in vertical iron retorts, each consisting of a heavy casting with a number of vertical holes, like a bundle of pipes all fused together. Two covers, one at each end, close the retort." There is no resemblance between this retort and the broad shallow horizontal iron retort described in the master patent; and the vertical retorts mentioned also in the latter appear to have been of a totally different design. The new form of vertical retort seems to constitute no mere "improvement," but a really revolutionary change.

Did the shareholders in the British Coalite Company supply their money in order that its technical staff and advisers should devote a year and more to devising plant to supersede that which the Company bought and held as one of its chief and impregnable assets? Are they satisfied now that the new coalite—*i.e.*, that made in the "improved" plant—is identical with the old coalite of the original plant? And if they are satisfied that it is, do they believe, in the light of the change of procedure in their own works, that a similar product cannot be made by yet other types of plant and modes of operating, in respect of which their Company holds no patent rights at all? American, German, and other important patents may have been sealed, and the patents held by the Company may or may not be unassailable; but we opine that they merely cover particular plant for, and modes of, making a certain grade of semi-carbonized fuel from coal. Is there not a strong probability at least that the same, or may we say a better, grade of such fuel can be produced in other plant and by other modes of working? Even the brief experience of the British Coalite Company prompts an answer in the affirmative.

Criticism of other features of the boom of the new Coalite may be deferred to another issue of the "JOURNAL."

MANCHESTER ELECTRICAL EXHIBITION.

[THIRD ARTICLE.]

THERE is very little electric cooking apparatus on view at the exhibition; and someone had the audacity to whisper in the ear of the writer when standing amid this beautiful collection of electricity-consuming appliances that visitors to, and attendants at, the exhibition, if they dine on the premises, are fed on gas-cooked viands. If this be true, then a sort of fraud is being perpetuated on the public; and the public ought to know of it, before purchasing electric cooking appliances. Further we say, if true, there are reasons for this preference for gas over electricity; and these reasons are no doubt found in economy of money and of time, and in reliability. In the exhibition, there is a model home designed, built, decorated, and furnished by Goodall's, of Manchester, in the expenditure upon which home we should say the electrical equipment will show up as a rather bulky proportion. There is in this model home—it would not be model or complete otherwise—a kitchen, about which the following roseate language is employed: "Here the all-potent mysterious electricity is working wonders. In a bright tiled kitchen, unsullied by soot or smoke, it is roasting, stewing, boiling, chopping, mixing, boot-cleaning, knife-cleaning—in fact, allowing for giving full swing to the genius of the cook, no excuse now exists for a badly cooked dinner." There is, as a rule, an objection to boot and knife cleaning going on where a dinner is being cooked; and why boot and knife cleaning should assist in removing the excuse for a badly-cooked dinner, it is difficult to appreciate. But before the General Electric Company fitted up this kitchen, Goodalls apparently think that legitimate excuses did exist for badly cooked dinners, inasmuch as "no excuse *now* exists," &c. We are not hazarding much in saying that not a few electricians have enjoyed in London, Manchester, and elsewhere many an excellently gas-cooked dinner, which they have pronounced good, and a repetition of which they would not miss—given the opportunity. If these dinners have been well cooked by gas, then what has been done in the past can be done in future. But it is easy to imagine circumstances under which, through some derangement of electric appliances, or collapse of the electricity supply, many a good dinner would be spoilt.

The model house to which reference is made is one of the most popular features of the exhibition, though most people doubtless go in and pass out feeling that such decoration and appointments as are found there—which, apart altogether from electricity, go to make the rooms pleasant and picturesque—are not within the reach of their purses. The house is intended to illustrate practically the "magnificent triumph of electricity;" it illustrates the

magnificent triumph of furniture. Entry is gained to the house by the "Sesame" door, which opens automatically when the visitor steps upon the mat, and closes quietly when he steps off. This piece of ingenuity should receive a very hearty welcome from burglars and other men of loose notions on the question of self-help. There is not the remotest intention of saying that the electric lamps with which the house is lighted do not give a pretty effect; but equally as good effect could be obtained by the proper fitting up of bijou gas-burners, and at far less cost, and with greater reliability thrown in. The experience is that, if anything does go wrong with the electric lights in a house, it is bound to be at the most inconvenient time. The firm of Goodalls have caught badly the *bizarre* form of description that is now the vogue among electricians. Listen to this amusing piece of orient composition:

Delicate schemes of decoration colour under the old *régime* of smoky open fires and destructive gas lighting, were extravagant and all too soon ruined. Now, at length, it is possible to indulge the fancy with painted ceilings and daintily tinted walls, now the corrosive fumes from the gas-pipes no longer attack and destroy the hangings and draperies, and ere long the dreaded spring cleaning will be almost a thing of nought.

What on earth Goodalls mean by all this, we have no idea. It is remarked, however, that they are talking of the "old" *régime* of gas lighting, and not of the modern. It would be highly edifying to get from them an explanation as to what is intended by the passage, "The corrosive fumes from the gas-pipes no longer attack and destroy the hangings and draperies." Whether electricity or gas be used, sanitation demands the "dreaded spring cleaning." Let us suggest to Goodalls that with the proper fitting up of the bijou inverted gas-burner in drawing-rooms and so forth, ceilings can be kept as clean as with electric light; and the economy between these gas-burners and electric lamps will largely meet the cost of the special annual turn-out that, in the interests of health, every home requires. It is ludicrous for sane people to write as Goodalls have written, as though electric light is so sublime that it negatives the requirements of cleanliness and health.

In the house, there are electric "radiators" (or rather they are called "radiators"), the fronts of which are fitted with red glass. They look pretty; but radiators have another purpose to serve, and that is to diffuse heat. These particular radiators are, with their red glass fronts, "make-believes" of the worst type. On top of them, one can place a hand and keep it there without the slightest discomfort. Perhaps we shall be told that the answer to this is that these particular radiators are merely for show purposes, and have not been properly fitted, to which the retort would be, "Then what on earth is the good of showing them?" Their virtue as heaters is what the public want demonstrated. There are other exhibitors showing radiators. The Dowsing Company, for instance, are exhibiting their "four-heat" lamp radiators, which "consume no air, and produce no fumes" and precious little heat, nor do anything to assist in keeping the air of a room in circulation. In the performance of these services, one unit of electricity is used by the four-heat type radiator. The firm forget to mention that this does not mean one unit per day, but one unit per hour. That, of course, is an oversight. The price of electricity for heating in the Manchester district is 2d. per unit; so that if one of the radiators is in use in a living room from 8 a.m. to 10 p.m., the expenditure on electricity will be 2s. 4d. per day, or in seven days 16s. 4d. A radiator of this kind is "usually"—the term implies not always—"found to be of ample capacity for warming rooms 12 feet square, and of the ordinary height." The people of Manchester will no doubt consider very carefully the economical heating proposition held out to them here. On examination, they will agree that one has to be capable of strong self-deception to work up the belief that electric radiators are the heaters for a room in the depth of winter. The Dowsing Company have also on view electric light baths, which seem to be capable of curing all the ills that flesh is heir to. While on the subject of heating, it is observed that Mr. S. N. Brayshaw, of Manchester, is showing in the exhibition furnaces for hardening steel; the heating agent being gas.

In an industrial district such as Manchester, the question of motive power is one of considerable interest; and it is naturally hoped that the exhibition will yield well in this direction. Electric motors are shown in good variety; and, in certain instances, their application to manufacturing requirements is attractive. Actual demonstration of operation is always more magnetic than any amount of idle plant. It is noticed in this connection that several of the makers of motors are now announcing that their starters are "fool-proof," and that their switches are ironclad. One firm alone shows patent "fool-proof" switchgear, methods of "fool-proof" distribution, and "fool-proof" combined switch fuse and plug for portable machinery. For protection, it is just as well that makers of such electrical plant should in construction take precautionary measures; but the anxiety that is displayed in assuring that this and that are "fool-proof" sends one away strongly impressed with the notion that the electrical industry must have had some bad experience in the past with fools, and expect to have a large association with them in future. Hence the necessity for their protection.

Among numerous other electrical appliances on view are, of course, electricity meters; but prepayment arrangements are more prominent by their absence than presence. One firm are exhibiting various prepayment devices, including a prepayment hour-meter. Ventilation appliances and blowers are plentiful, including in the latter class gas-tight blowers specially constructed for producer-gas plants. This brings us to a short notice of the gas-engines and suction-gas plants on view. The plants are not of large power; and the names of the makers leave nothing to say as to workmanship, &c. Messrs. Crossley Bros. are to the fore with, among other plants, a four-cylinder vertical gas-engine, with 11¼-inch diameter cylinders and 14-inch stroke, running at a speed of 220 revolutions per minute. It is coupled up to a 75 kilowatt dynamo. The engine is supplied from a suction-gas plant; but it has to be started by a small compressed-air plant, consisting of a little horizontal oil-engine combined with an air-pump—the air being stored in steel receivers at a pressure of 180 lbs. But a pressure of 80 lbs. is sufficient to start the engine at any time. An arrangement is made for working the engine with town's gas; and the change from one to the other can be effected without stopping the engine—capability for doing this being due to the Crossley patent governing-valve with which the engine is furnished. With suction gas the engine gives about 110 brake horse power, as against about 125-horse power when running on town gas. This is a closer comparison in proportion than we know has been actually obtained with smaller engines in London. The firm are also showing one of their standard type horizontal engines, running at slow speed for driving ordinary machinery. In this case, the comparison is as between about 48-horse power on town gas and 37-horse power on suction gas. The latest improvements are incorporated in the engine; and there has been a general remodelling, with the view to increased strength, accessibility, and efficiency. Other types of engines are shown by the firm. The National Gas-Engine Company, Limited, who state that their gold medal (Royal Agricultural Society's Derby show) suction-gas plant and engine will give 10 to 20 horse power for 1d. per hour, according to locality, are exhibiting various engines and plants. One of the engines on view is credited with a capacity of 100 brake horse power using suction gas, and 120-horse power with town gas. There is also a combined electric lighting set for use with town gas, which will not render a bad account of itself in the matter of costs in competition with electricity from the town cables. Messrs. F. V. Brown and Co., in conjunction with Messrs. T. H. & J. Daniels, Limited, are showing various engines, one of which on town gas will give 20-horse power, but 25 per cent. less on suction gas. Photographs and drawings of large gas-engines are shown by the Nuremberg Gas-Engine Company. Messrs. W. J. Bates and Co., Limited, have on view a 25 brake horse power engine with a suction-gas plant, the makers of which, it is interesting to note, are the Power Gas Corporation. The Heatly-Gresham "Rational" set, and its claims in the matter of costs in competition with town electricity, were noticed last week.

Turning to a few other stands that merit notice from readers. There are the exhibits of the James Keith and Blackman Company, Limited, principally of fans and blowers; among the latter being blowers for suction gas and producer gas plants. Reference was made last week to part of the exhibit of Messrs. Alexander Wright and Co.; but it should be mentioned that the very photometers and portable calorimeter described and illustrated in our issue for Oct. 6 (p. 33) are to be seen here. The Kennedy Pipe-Bending Machine Company are showing their portable and hand machines for bending gas, steam, and other pipes. The Venturi meter for hot water and boiler feed-water is shown by George Kent, Limited; and Glenfield and Kennedy, Limited, are displaying their water valves, indicators, recorders, meters, taps, &c.

Now let it be said in conclusion that, as a collection of electrical exhibits, the show is, if eyes can be shut to the defects commented upon in our first article, a good one; and it will be seen, from what has been stated in these articles, that, where many of the exhibitors expose themselves to the strongest criticism is in exaggerated claim. If it were not for their pretensions, there would have been little calling for criticism in these pages.

Association of Water Engineers.—The winter meeting of this Association will be held at the Geological Society's apartments, Burlington House, Piccadilly, on Friday and Saturday, the 11th and 12th of December. Business will commence at two o'clock on the first-named day, and will be adjourned about mid-day on the 12th. We learn from the Secretary (Mr. Percy Griffith) that the principal item in the programme will be a lecture by Dr. Hugh Robert Mill, an honorary member of the Association, on "The Measurement of Rainfall," illustrated by lantern slides.

Tendering for Public Appointments.—Under this heading, the "Chemical News" publishes a letter from the Hon. Secretaries of the Society of Public Analysts, enclosing a copy of a resolution which was unanimously passed at a special Council meeting of the Society held on the 1st inst.—such a resolution as might well be passed by the Council of the Institution of Gas Engineers. It is as follows: "The Council of the Society of Public Analysts and Other Analytical Chemists has had under consideration the practice which has been adopted recently by certain public bodies, of inviting applicants for the office of public analysts to state the terms upon which they are prepared to accept such appointments. The Council is of opinion that it is against the interests of the public, and degrading to the profession of analytical chemistry for appointments to be offered 'on tender,' and calls upon the members of the Society to resist the practice."

THE DOMESTIC VALUE OF "COALEXLD."

Results of the Demonstrations at Morecambe.

As mentioned in the "JOURNAL" last week, Mr. James Jowett, the producer of the new domestic fuel to which he has given the name of "Coalexld," made arrangements for a series of practical demonstrations of it to be carried out during the week at a house in Skipton Street, Morecambe. We are informed that they were attended by highly satisfactory results; the premises having been visited by a large number of the residents (200 daily, and between 300 and 400 on Thursday), together with members of the medical profession and of neighbouring local authorities and some gas engineers and managers. Representatives of the local Press testify, from personal inspection of the fuel burning in several rooms of a large house, that coke produced by Mr. Jowett's process ignites readily, burns freely, does not emit noxious fumes, and leaves little or no ash and no clinker. As a "Coalexld" fire cannot smoke, it is a remedy for the troubles of dust, dirt, and damage to which the use of coal gives rise; and—most important of all to the housewife—a large fire can be maintained for about twelve hours at the cost of a 1d. Where a blaze is preferred in conjunction with the red glow given by the fuel, it can be mixed with coal, a poor quality of which will be much improved in consequence.

The point of special interest to our readers is that an extended use of "Coalexld" would mean a considerable diminution of the stock of coke in gas-works yards. No plant is required for its production; the only important matter to be attended to being to work one bed of retorts under Mr. Jowett's special treatment, and to give instructions that the residual from this bed should be stacked apart from the ordinary coke. One bed could be worked to begin with, and others could be added as the demand for the fuel increased. The experience of the past week "justifies the expectation" that stocks of coke will eventually become non-existent; the use of domestic fuel affording a large field for its utilization. The Manager of the Morecambe Gas-Works (Mr. H. Blakey) is operating Mr. Jowett's process; and we give below his opinion upon it.

I have been making "Coalexld" for the past eight months; but the sales have been of a limited character, owing to the strong prejudice against gas coke. Since the demonstration commenced, however, the inhabitants are so satisfied as to its utility and pleasant use, that the sales have increased 100 per cent., and the orders are repeating. I fully anticipate that ere many months pass I shall be able to chemically treat the whole of the coal that is carbonized at Morecambe. Its advantages as a domestic fuel are numerous: (1) the entire absence of sulphurous fumes; (2) it leaves little or no ash, and no clinker; (3) it ignites readily and burns freely; (4) the calorific value is exceedingly high; and (5) it is smokeless. During the demonstration, a room 15 feet square was kept at a temperature of 70° Fahr. for over ten hours at the cost of 1d. I find no inconvenience in manufacturing the fuel; the process being very simple. The chemicals are supplied ready for use, therefore giving no trouble and causing no extra labour. As this becomes universally adopted by gas engineers, it will open a new market for the disposal of the residual coke, in the form of "Coalexld," which will prove a financial benefit to every gas undertaking.

It only remains to say that Mr. Blakey has had to put a larger number of retorts under Mr. Jowett's process, to keep ahead of the orders received for the new fuel. When the demonstration started on Monday last week, orders were placed and executed next day; the purchasers testing it for themselves at their homes, and subsequently applying for larger quantities. We are assured that only one opinion, and that a very favourable one, has been expressed in regard to "Coalexld;" and it found expression in applications being received on Thursday for upwards of 13 tons, in samples, for domestic purposes alone, the total bookings in sample bags reaching 50 tons.

PROPOSED GAS & ELECTRICITY TAX IN GERMANY

SOME time ago, a rumour reached England that a proposal was on foot for the taxation of artificial light in Germany, with the view of improving the financial position of the Empire. According to the Berlin correspondent of "The Times," it was stated in the speech from the Throne to the Prussian Diet last Tuesday that additional revenue to the amount of £10,000,000 per annum was required, though only about one-fourth of this sum is to be raised by means of fresh taxation. In conjunction, however, with the forthcoming demands of the German Imperial Government for extra revenue to the extent of £25,000,000 a year, the prospect for the Prussian taxpayer is, as the writer remarks, anything but reassuring, and the new financial proposals are now being very seriously discussed. With regard to the suggested tax on company trading profits, it is noted that this new Prussian impost will represent an extremely serious burden, if working expenses are to be materially increased by the exaction of fresh dues for Imperial purposes in the shape of a tax on gas and electricity. By one of its now proverbial "strokes of good fortune," the Socialist paper, "Vorwärts," is in a position to publish what purports to be the text of the Government proposals in this connection. According to this paper, the portion of the finance scheme referred to comprises five sections, the first of which deals with the taxation of gas and electric power, and the second with the taxation of gas and electricity as illuminants. The proposed charges are said to amount, in the case both of power and of light, to 5 per cent. of the price to the consumer, but to not more than 0·5 pfennig per cubic metre (equal to 1·7d. per 1000 cubic feet) of gas or per unit of electricity. Electric lights and lamps are to be taxed at the rate of 10 pfennige (1d.) for 10 watts; and the tax is to be imposed at a progressive rate. Incandescent gas-mantles are to be charged at the rate of 10 pfennige each; and carbon rods or filaments for electric arc lamps at the rate of 1 mark (1s.) per kilogramme. Oxide filament lamps are to be taxed at this rate per lamp up to 100 watts, and 1 mark for every additional 100 watts. The "North German Gazette" on Thursday stated that the proposals had been published without authority, and that certain changes had been made in them since they came before the Bundesrat.

Our contemporary's correspondent points out that the municipal gas-works in Berlin supplied gas to the value of nearly £1,500,000. The charge to the consumer is from 14 to 16 pfennige per cubic metre (4s. to 4s. 6d. per 1000 cubic feet). A tax of 5 per cent. would therefore diminish the municipal revenues from this source by about £75,000, unless indeed the price were to be raised. Since the profits to the Corporation amounted to about £450,000, the net earnings would be reduced by more than 16 per cent. Similarly in the case of the supply of electric light and power. Though the Municipality have no supply stations of their own, they hold a considerable interest in the electricity works, which last year put nearly £250,000 into the municipal coffers. It is estimated that this revenue would be curtailed by the new tax to the extent of about £12,500. It is reported that a conference of municipal representatives is to be convened in order to protest against the proposals of the Government.

REPORT ON EFFICIENCY TRIALS OF THE VERTICAL RETORTS AT THE MARIENDORF GAS-WORKS, IN BERLIN, AND THE SCHLIEREN GAS-WORKS, IN ZURICH.

THE Instructional and Experimental Gas-Works of the German Association of Gas and Water Engineers, at the request of the Vertical Retort Company, of Berlin, undertook that its staff should conduct large working-scale tests of the vertical retort installations at Mariendorf and Schlieren in May last; and the results of these trials are shown in the appended table. The conditions prevailing in the trials were the usual working conditions of the works in question. But during the trials greater uniformity of working was ensured; and the results of the observations were computed so as to be as far as possible comparable. Where it became necessary to deviate from the scheme laid down for the trials, owing to local conditions, the observations were made in such a way that the results obtained should be, as far as possible, on the same basis. Any departures from this scheme are apparent from the table.

The arrangements were made throughout with a view to ensuring satisfactory results. The instruments and apparatus used in the trials were standardized. The trials themselves were made on the full working scale; and the period covered by them thus represents truly the continuous work of the plant, with the exception that during the period the scurfing of the retorts and the customary admission of air for purification were suspended. At both works the trials fell into two groups, of which the first comprised carbonization with the admission of steam, and the second simple carbonization without any admission of steam.

At the Mariendorf works in Berlin, a bench of seven beds, each containing twelve vertical retorts, 5 metres (16·4 feet) in length, was used for the trials. On the average, this bench carbonized 87·9 metric tons (86·5 tons) of coal per twenty-four hours, with an average charge per retort of 580 kilos. (11·4 cwt.). The coal used was a mixture of Silesian coals taken from the works' store. Its composition will be dealt with later. When steam was admitted, the charge was kept in the retort for twelve hours, during the last 2 hours and 20 minutes of which period the steam admission took place. When no steam was used, the charge was worked off in 10½ hours. The charging and discharging of the retorts went on smoothly throughout the experimental period.

At the Schlieren works in Zürich, the trials were made on an installation of two benches, each containing five beds of ten vertical retorts, 4 metres (13·1 feet) in length. These 100 retorts, on the average, carbonized 114 metric tons (112 tons) of coal when steam was admitted, and 120 metric tons (118 tons) when the working was without steam. The weight of charge per retort averaged 500 kilos. (9·84 cwt.) The coal carbonized here was Saar coal from various pits. When steam was admitted, the charge remained in the retort for 10 hours 40 minutes, during the last

	Mariendorf Works, Berlin.									Schlieren Works, Zürich.						
	With Steaming.				Without Steaming.					With Steaming.				Without Steaming.		
Date of trials . . . . . May, 1908	18–19	19–20	20–21	21–22	Mean	22–23	23–24	24–25	25–26	26–27	Mean	18–19	19–20	20–21	Mean	21–22	22–24	Mean
Duration of trial . . . . . hours	24	24	24	24	..	21½	21	21	31½	21	..	24	24	24	..	30	40	..
Charge worked off in . . . . . ,,	12	12	12	12	..	10⅜	10¼	10¼	10¼	10¼	..	10⅜	10⅜	10⅜	..	10	10	..
Weight of charge per retort. . . . . lbs.	1,290	1,281	1,276	1,276	1,281	1,265	1,254	1,250	1,243	1,252	1,252	1,085	1,134	1,125	1,113	1,102	1,109	1,106
Temperature of retort, lower part. . . . . deg. C.	1,308	1,310	1,300	1,290	1,302	1,290	1,300	1,290	1,285	1,275	1,288	1,410	1,370	1,355	1,378	1,325	1,335	1,330
,, ,, upper ,, ... ,,	1,240	1,235	1,223	1,210	1,227	1,202	1,200	1,230	1,215	1,200	1,209	1,260	1,235	1,243	1,243	1,180	1,228	1,204
Coke used for heating, per cent. by weight of coal carbonized .	13·5		14·7		14·1	14·3		14·8			14·5	..	..	..	15·0	..	..	13·9
,, ,, ,, lbs. per 1000 cubic feet of gas made	22·3		23·8		23·0	28·7		28·9			28·8	..	..	..	24·4	..	..	25·7
Gas made per ton of coal, cub. ft. (dry) at 0° C. and 760 mm. .	12,775	12,811	12,990	12,882	12,882	10,406	10,370	10,622	10,801	10,909	10,622	13,169	12,811	12,631	12,882	11,268	11,339	11,303
,, ,, ,, ,, (saturated) at 60° Fahr. and 30 in. bar.	13,708	13,744	13,959	13,815	13,815	11,196	11,160	11,411	11,268	11,734	11,339	14,138	13,744	13,564	13,815	12,129	12,165	12,147
Coke (dry) obtained, per cent. by weight of coal carbonized .	..	..	..	..	63·78	..	..	..	..	..	64·04	67·7	67·6	66·5	67·2	69·3	69·4	69·3
Illuminating power of gas in candles per 5 cubic feet per hour—																		
In Carpenter ("Metropolitan" argand No. 2) burner . . .	12·12	12·57	12·75	11·84	12·32	15·37	16·13	16·52	15·36	17·15	16·10	..	..	..	..	..	..	..
,, flat-flame slit burner	..	..	..	..	..	..	..	..	..	..	..	..	5·92	6·04	5·95	8·77	8·63	8·70
Calorific Power, gross B.Th.U. per cubic foot.	545	553	541	546	546	591	584	599	598	597	594	566	573	571	570	604	596	600
,, ,, net ,, ...	493	494	485	487	490	527	523	537	535	537	532	506	510	509	508	536	532	534
Percentage of nitrogen in the gas	1·2	1·4	1·1	1·6	1·3	1·1	1·2	1·1	1·2	0·9	1·1	..	..	..	..	..	..	..
Percentage of breeze in the coke obtained	..	..	..	..	7·8	..	..	..	..	..	7·4	..	..	..	..	..	..	..

1½ hours of which period the steam was introduced. When no steam was used, the charge was worked off in 10 hours. In this case, also, the charging and discharging of the retorts proceeded smoothly throughout the trials.

The weight of coal used was determined by filling the coal-bunker from which the retorts were charged with weighed quantities of coal. The weights were determined daily, and the mean taken over the whole period of the trials. In the same way the weight of coke used for heating the retorts was determined, but over a longer period. The moisture contained in the coal and coke was determined on average samples carefully taken, and referred to the air-dried coal or to dry coke. The portions of the fuel which escaped unburnt in the clinker were taken into account—at Berlin, by deducting the coke picked out from the clinker from the weight charged into the furnace; and at Zürich, by estimating the combustible matter in all the ash and calculating it as unconsumed coke, which was then deducted. The make of gas was observed every hour, together with the temperature and barometric height. The volumes of gas were then reduced to standard conditions. The yield of coke was determined at Mariendorf by weighing all the coke produced from the whole bench of retorts during the trials. Having regard to the varying proportion of water introduced into the coke by quenching, large average samples of it were taken carefully, and the moisture estimated by drying, and deducted from the total weight. At Zürich, the whole of the coke produced could not be weighed; and the yield was therefore determined separately on 51 retorts. The tar and liquor were not determined.

The quality of the gas made was ascertained by tests of illuminating power and calorific value. In Berlin, the (Carpenter) "Metropolitan" argand burner, No. 2, which is that prescribed for the official testing of illuminating power in London, was used at 5 cubic feet per hour rate of consumption. [The 5 cubic feet, however, appears to have been taken at 0° C. and 760 mm.; whereas in London it is, of course, taken at 60° Fahr. and 30 inches. The necessary correction to English standard conditions has been made in the table.] At the Zürich works, the illuminating power tests were made with a hollow-top slit flat-flame burner at the rate of consumption of 150 litres (5·3 cubic feet) per hour. [The figures given in the table refer to the light afforded by 5 cubic feet of gas burned in these conditions.] The calorific value was determined by the Junkers calorimeter. Both determinations were made on average samples of gas taken continuously during each set of trials; and also frequently during the trials separate observations were made. The results of the two sets of observations showed good agreement.

The appended table has been prepared from the somewhat more detailed one giving the results in metric quantities which accompanies the original communication. The Mariendorf trials were carried out by Dr. K. Bunte and Dr. Schumacher on behalf of the Instructional and Experimental Works of the Association; and the Zürich trials by Dr. Henseling and Dr. Spreng. The members of the gas-works' staffs who assisted in the experiments were, at Mariendorf, Dr. Geipert, and Herren Hüttner, Schulz, and Volger; and at Zürich, Dr. Ott, Dr. Bosshart, and Herren Sautter, Burkhard, Ulrich, Jaussi, and Griot. The report is signed on behalf of the Instructional and Experimental Gas-Works at Carlsruhe by the Director, Professor H. Bunte.

THE BENS AIR-GAS PLANT.

Petrol and incandescent gas-burners have much to answer for in making the path straight and plain for the introduction of several competing systems of air-gas production—most of which have variations in regard to the construction of plant, and all of which produce results that are as akin as it is possible to make them. There is no help for this. The two ingredients of the gas are air and petrol. Air is free to all the makers of these plants alike; they are not allowed any selective preference in the matter. Petrol is a commercial article that is as purchasably free to the users of one system as to another. Comparison of the claims as to efficiency and other advantages shows, whatever the form of the plant, a uniformity in detail that is striking, but not surprising to anyone capable of applying a little elementary knowledge and common sense to their consideration. It is therefore in the conveniences of the plant, and in the degree of perfection to which the appliances specially adapted for the gas are brought, that individuality and superiority in efficiency must be looked for. If we are not right in this, then we shall be interested to hear the contrary views of those immediately concerned in the plants.

Among the plants that have not hitherto been specially noticed in these pages is that of the Bens Gas Company of Chichester. It is a very simple plant, occupies a small amount of space, and is constructed in sizes equal to 30 lights upwards to any number that a consumer may desire. Of course, like the other plants, claims are made for it regarding the cheapness of the product in comparison with coal gas; but gas men distributing coal gas can nevertheless give such plants welcome, as being useful in isolated places where gas-mains have not yet penetrated, with the placid feeling that where a 50-candle power light can be obtained by the consumption of 2 cubic feet of coal gas obtainable by simply turning a tap, there are not many people who will be prepared to become gas manufacturers on their own account, purchase the plant, store petrol, and have to start a little air-engine driving

the plant each time light is wanted or a chop has to be cooked. For places, we repeat, where there is no cheap public gas supply, these plants will be very useful. We know from inquiries that have been made through the "JOURNAL" offices, that the advice of gas managers is often sought regarding their installation in rural districts; and as information spreads, their advice will no doubt be sought more frequently.

As remarked, the Bens plant is of a very simple construction. It consists of a small hot-air engine (with water-cooling tank attached) driven by the gas made by the plant. This engine, through a small belt drive, operates a little blower, which feeds into an air-holder, whence the air passes to the petrol carburettor, where it mixes with the vapour of the petrol, and then flows away to the holder above. There is nothing special about any one part of the plant. The air-holder and the gasholder above the carburettor are weighted and water-sealed. The carburettor is quite automatic; the whole plant, in fact, answers immediately, after being started—an operation which engages attention but for about two minutes—to the demands made upon it. No gas more or less is made than is required—no matter whether there is only one light going or twenty or more. We understand that the engine can be run for twelve hours for 2d. The plant occupies only a small space—a sixty-light plant merely requiring some 3 ft. by 5 ft. 6 in. The gas from the holder is distributed in the usual way—an ordinary gas-piping system being all that is necessary; but the burners, stoves, and so forth must, of course, be specially adapted for a mixture of this kind. The production is regulated so that the gas, according to the information supplied, is composed of 98½ per cent. of air and 1½ per cent. of petrol vapour; and this, of course, is non-explosive. In the event of any escape, there is practically no smell. The other advantages ascribed to the plant are that there is no blackening of the ceilings, no deleterious products, no destruction of pictures, no condensation in the pipes, no corroding of fittings, no blackening of the porcelain cones of the inverted burners used, no blackening of the bottoms of the metal utensils employed for cooking or water heating, and the burners are kept very clean. The characteristics are ideal.

Before treating of the question of efficiency, it may be mentioned that the burners used are adaptations of the "Nico" type of the New Inverted Company; and they are made in various sizes for the purpose so as to give a light from 25 candles up to 300 candles. But the bijou and a 50-candle power burner are the preferable units. The Davis Gas-Stove Company have adapted makes of their stoves and appliances for this plant. Now with regard to the efficiency of the Bens gas. If we take the price of petrol at 1s. per gallon, then the cost of the petrol for maintaining twenty lights of 50-candle power for an hour would be 1½d.—that is to say, a pint of petrol will give, using inverted incandescent gas-burners, a light of 1000 candles for an hour. A gallon of petrol will produce 1600 cubic feet of gas—that is to say, a gallon of petrol of a specific gravity of 698 to 700 will produce 24 cubic feet of hydrocarbon vapour, and, adding to this 1576 cubic feet of air, we have the most dilute possible mixture for lighting and burning. The consumption of gas by a 50-candle power burner is 10 cubic feet; and the mantles are beautifully incandescent. From these figures several calculations can be made to meet any cost of petrol; but it will be noticed that the figure quoted here only embraces the price of the petrol.

The engineer of the Company has made a number of trials of the heating value of the gas; and from them it is learned that, using a small ring-burner and an 8-inch tin-kettle, a pint of water can be raised from 60° to 212° in six minutes, using 3 cubic feet of gas. The same quantity of gas will melt 2 lbs. of ice, or heat a gallon of water 50° Fahr., melt 2 lbs. of lead, heat 1500 cubic feet of air 30°, or evaporate 6½ oz. of water. It is also calculated that 3 cubic feet of the gas should well maintain a rise of 1° Fahr. for every 450 square feet of glass on a calm day; or the same amount of gas should maintain a rise of ¾° for every 300 square feet of glass in exposed positions. The gas, it is also pointed out, will not damage vines.

A point of some importance in view of the inflammable nature of petrol is the question of safety; and we learn from the Bens Company that arrangements have been made with an insurance company for the insurance of the plants against accidental damage, fire, or mechanical breakdown, at these rates: A 30-light plant, 10s. 6d. per annum; a 60-light plant, 20s.; a 100-light plant, 30s.; and a 150-light plant, 40s.

MIDLAND ASSOCIATION OF GAS MANAGERS.

Meeting in Birmingham.

The Autumn Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham—the PRESIDENT (Mr. H. E. Copp, of West Bromwich) in the chair. There were about fifty members present; but the meeting of the Gas Companies' Protection Association the previous day and of the Council of the Institution of Gas Engineers the same day were responsible for a few absentees.

The HON. SECRETARY (Mr. Charles Meiklejohn, of Rugby) opened the proceedings by reading the minutes of the summer meeting at West Bromwich; and they were confirmed.

THE LATE SIR GEORGE LIVESEY.

The PRESIDENT said, before proceeding with the business of the meeting, he had rather a sad note to sound. Since the last gathering of the Association, the industry had lost its great and good friend in the person of the late Sir George Livesey. Much had been said about him, and many well-expressed appreciations had appeared in the Press, all of which they knew to be perfectly true. Sir George Livesey was thoroughly deserving of it all. It would ill-become him (the President) to add to what had been written; and he would therefore at once call upon Mr. Smith to propose a resolution of condolence to be forwarded to Lady Livesey.

Mr. W. B. SMITH (Walsall) said that, having only a few minutes previously been called upon to address the meeting on this painful subject, he had not formulated any resolution. But he wished to say, and he thought he was expressing the feelings of all the members—not only present, but absent—how deeply he regretted the loss that had been sustained by the gas profession and gas industry generally in the death of Sir George Livesey—a man well known by every member of the profession, not only for his kindness of heart to each and everyone who had applied to him, but also for the guidance he had given in their difficult sphere of life. No words of his (Mr. Smith's) were adequate to express the sense of sorrow he personally felt in having to propose a resolution of this kind; and he thought if the President would leave the drafting of the resolution in the hands of the Hon. Secretary, he would put it in a form that would properly convey their feelings.

Mr. FLETCHER W. STEVENSON (Coventry), in seconding the resolution, said Sir George was such a friend to all those interested in gas engineering, and to those who took part in the management of gas undertakings, that they must all deeply feel his loss. As the President had said, many appreciations had appeared in the Technical Press, as well as in the Daily Press, with regard to Sir George; but, nevertheless, he was sure they all felt that they would be failing in duty if they did not, as an Association, pass a resolution such as was proposed, and forward it to the widow and relatives. Personally, his earliest recollections of Sir George was as a young man meeting him in North Wales when there with his (Mr. Stevenson's) father. He then saw their friend, hammer in hand, breaking rocks in searching for fossils. One of his cherished latest remembrances of him was on the occasion of his (Mr. Stevenson) going to Coventry. He then had a letter from Sir George, couched in such terms that he would not have thought any man in his (he might say) exalted position in the profession would have used, showing, as this kindly, thoughtful, and encouraging letter did, the interest he took in every individual in the profession. That was like him in dealing with every gas manager throughout the kingdom. It did not matter to him whether the manager was in a good position of management, or in a small one, he was equally kindly, generous, and thoughtful, and ever ready to give advice; and his works were always open to every one.

The resolution was approved by the members standing.

THE HON. SECRETARY.

The congratulations of the members were, on the suggestion of the President, tendered to the Hon. Secretary on the recent escape he has had from shipwreck, in connection with the accident to the *Argonaut*. The President remarked that this was a fitting occasion to place on record their satisfaction that Mr. Meiklejohn came safely through that trying ordeal. He had also lately been laden with municipal honours, and upon that they also congratulated him.

ELECTION OF OFFICERS.

The PRESIDENT remarked that there being no other nominations, the following gentlemen were elected office-bearers for the ensuing year:—

President.—Mr. W. Langford, of Longton.
Vice-President.—Mr. Vincent Hughes, of Smethwick.
Hon. Treasurer.—Alderman W. R. Cooper, J.P., of Banbury.
Hon. Secretary.—Mr. Charles Meiklejohn, of Rugby.
Committee.—Mr. A. Bird, of Bromsgrove, and Mr. B. Ely, of Pye Bridge.
Auditors.—Mr. Thos. Watson, of Rushden, and Mr. W. J. Jones, of Brierley Hill.

NEW MEMBERS.

The PRESIDENT announced that the following nominations for membership had been received:

Mr. J. W. Felton, of Stourport; Mr. Charles E. Parsons, of Bewdley; and Mr. George W. Hurst, of Shepshed.

Moved by Mr. SIDNEY O. STEPHENSON (Tipton), and seconded by Mr. A. COOKE (Oldbury), the gentlemen named were added to the roll of members.

PAPERS AND DISCUSSIONS.

The following papers were read: "High Pressure Distribution," by Mr. C. H. WEBB, of Stourbridge; and "The Cultivation of Slot-Meter Consumption," by Mr. SIDNEY O. STEPHENSON, of Tipton. The text of the communications and the report of the discussions are published in another part of this issue. There was also a paper by Mr. R. H. BRADBURY, Assoc.M.Inst.E.E., on a "Continuous Recording Calorimeter." The part of this dealing directly with the instrument appears below.

THE BEASLEY GAS-CALORIMETER.

Mr. R. H. BRADBURY gave a description (with the aid of lantern slides and a specimen of the apparatus in action) of the Beasley recording gas-calorimeter, a lengthy and fully-illustrated article on which will be found in the "JOURNAL" for July 30, 1907, p. 308. In the course of his paper, Mr. Bradbury said:

Perhaps it is unfortunate that for gases containing free or combined hydrogen there are two calorific values—the gross value and the net value. I am not assuming members to be ignorant of the difference between the gross and net calorific values of a gas; but as there seems to be a difference of opinion as to which standard should be adopted, and as I further wish my remarks to be free from ambiguity, I shall perhaps be pardoned for here referring to it.

When 1 cubic foot of carbonic oxide is burnt, 344 B.Th.U. of heat are liberated. Practically the same number of heat units are generated by the combustion of 1 cubic foot of hydrogen. In both cases, the gross calorific values are represented by the figure 344. If, however, the products of combustion are allowed to escape above 100° C., then the water formed by the burning of the hydrogen is converted into steam. A quantity of heat represented by the latent heat of steam is thus absorbed; and as this passes away with the exhaust gases, there is considerably less residual heat in the case of the hydrogen than in the case of the carbonic oxide Since it is the residual heat only which can be utilized for practical purposes, carbonic oxide is sensibly a richer gas than hydrogen, though of the two gases hydrogen has, if anything, a slightly higher gross calorific value. The thermal efficiency of any gas apparatus or gas-engine may be stated as the ratio of the utilized heat to the supplied heat. When all heat converters have reached the stage of perfection with efficiencies of 100 per cent., the burnt gases will only escape at atmospheric temperature, and there will be no need to discriminate between gross and net values. But as it is fairly safe to say that a thousand years will not see such conditions fulfilled, the difference between the two values must for the present be considered.

The calorimeter has been very carefully designed, and is made by the well-known firm of Parkinson and W. & B. Cowan, Limited. The Junkers water-cooled calorimeter is essentially an ideal heat absorber of 100 per cent. efficiency, and thus gives directly the gross calorific values. As it was not with the intention of recording the gross values, but rather the net calorific values, the Beasley calorimeter allows any water formed by the combustion of the gas to escape as water vapour; and the residual heat only acts as the motive power to operate the instrument. The calorimeter body is nothing more than a simple chimney; but in order that there may be a linear relationship between the heat units (net) supplied and the temperature of the chimney, the latter is

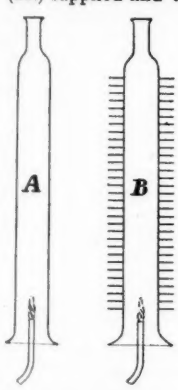


Fig. 1.

Fig. 2.

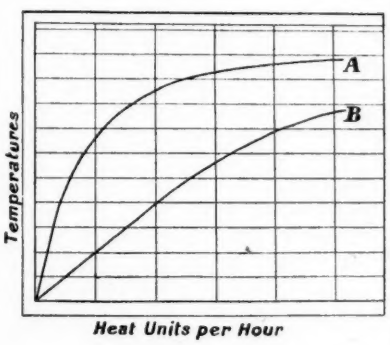


Fig. 3.

never allowed to attain an average temperature of more than about 50° C., though the products of combustion escape from the apparatus at about 140° C. To retain these conditions, and at the same time to burn a fair quantity of gas, the chimney has to be of relatively large heat capacity; and this is effected by means of radiators. In developing the calorimeter, not a few experiments have been made with different forms of chimney; and as a general result it may be said that, so long as the chimney is kept within certain temperature limits, the average temperature of the chimney above the surrounding air temperature is a direct measure of the heat supplied to it. Perhaps this will be more clearly understood if reference is made to figs. 1, 2, and 3. B is a radiated chimney; but in all other respects it is the same as chimney A. Both characteristic curves A and B show a straight line relationship for the lower temperatures; but in B, for the particular temperature at which the proportionality breaks down, the quantity of heat supplied is very much greater than it is for A.

For measuring the rise in temperature of the calorimeter chimney, a very ingenious differential thermometer is used. This is practically a U-tube with tanks fitted to each limb, and is filled with oil, which has a large coefficient of expansion.

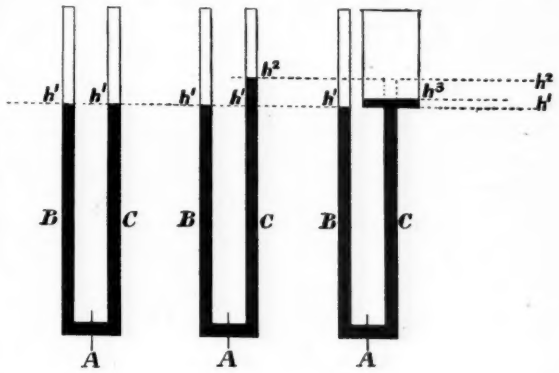


Fig. 4.

Fig. 5.

Fig. 6.

If B C be a U-tube of even bore filled with oil of density P at a temperature $t°$ to a level h^1, then the pressure exerted at A by each column of oil is equal and opposite, and is represented by h^1 P. If the oil in limb C is heated to a temperature $t°^2$, it will increase in volume, and rise to a level h^2 (fig. 5). If the volume was v at $t°$, then at $t°^2$ the volume becomes $\frac{h^2}{h^1} v$, and the density being the reciprocal of the volume is $\frac{h^1}{h^2}$ P. The pressure now exerted at A by the hot column of oil is $h^2 \times \frac{h^1}{h^2}$ P, and this simplified is h^1 P, which is the pressure given at A by the oil in the cold limb.

Therefore in a plain U-tube partly filled with oil there is no change of level in one limb caused by heating the oil in the other. For the registering part of the calorimeter, in order to operate the spindle carrying the pointer, it was necessary to obtain a rise of the oil on one side and a fall on the other. Supposing the limb C (fig. 6) terminates at h^1 in a tank, then when the oil is heated to the temperature $t°^1$ its density becomes $\frac{h^1}{h^3}$ P, as before. But the oil overflowing into the tank does not rise to the level h^2, but to a lower one h^3. The pressure by the cold column has remained unaltered, and is—

$$h^1 \text{ P or } h^2 \text{ and } \frac{h^1}{h^2} \text{ P.}$$

The oil in the limb now exerts a pressure $h^3 \times \frac{h^1}{h^2}$ P. This is less than that given by the cold limb, because h^2 is less than h^3; and for this reason oil flows from the one limb to the other. By having properly proportioned tanks, one fitted to each limb, it is easily possible to get for any difference of temperature a rise of the oil in the one tank and a corresponding fall in the other.

The calorimeter chimney is built of two concentric tubes; and it is the annular spaces A A (fig. 7) between these which form the hot limb of the U differential thermometer. The other limb which is radiated to keep it at the air temperature is shown at E. There are two floats F F, situated in the tanks B B; and these are connected by threads to pulleys arranged on a spindle H. This spindle rotates when the floats rise and fall, and operates a lever M carrying a marker, which traces the calorimeter record upon a moving band of paper. The clockwork T, which unrolls the paper, is fixed to the bracket K. The paper supply for one week's run is wound on a wooden spool, and is transferred for use to the roller P. The paper is drawn over rollers passing the back of the scale S in contact with the marking-pen to the long paper guide G, which is sufficiently long to always allow the exhibition of 24 hours' record.

The calorimeter is only a measurer of the heat supplied to it; therefore, if calorific values are to be recorded, there must be a constant stream of gas burned. The law which governs the flow of gas through a pipe system may be written

$$F = k \frac{P}{p}$$

where F is the flow or the volume of gas passing in a given time, P the pressure causing the flow, p the density of the gas, and k a constant. It is easy to establish a steady pressure; and if the gas is clean and of fixed density, all that is necessary is a sensitive pressure controller and a suitable jet in the burner. Unfortunately, the density of coal gas is subject to large variations; and on this account it is necessary to use a special controlling apparatus.

The pressure-regulator and what is termed the drag-meter are

shown in fig. 7. The pressure-regulator is of the ordinary type; but the dimensions of the different parts are carefully gauged to meet the exacting requirements of the calorimeter. The outer vessel A is filled with oil to the level L L, and forms a lute to the bell B, from the centre of which is suspended by a light chain a

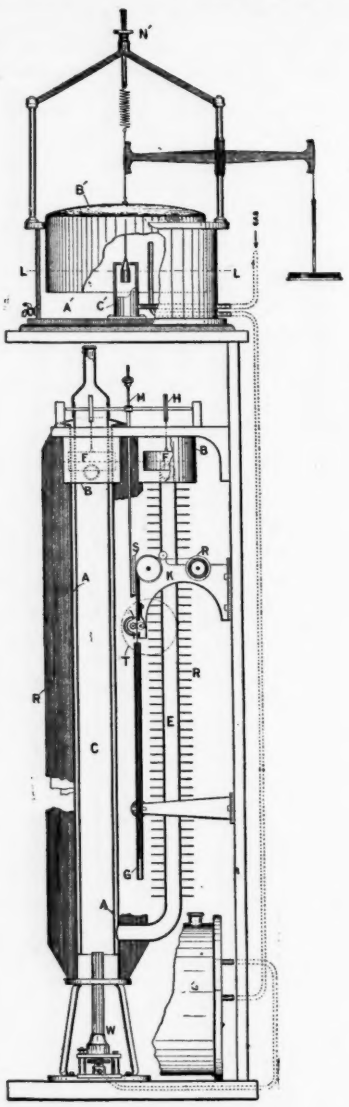


Fig. 7.—Section of Calorimeter.

somewhat heavy cone. For normal gas pressure, the bell B is counterpoised by a spring and balance-weight. An increase or decrease in the pressure raises or lowers the bell, restricting or opening the gas-passage between the suspended cone and the feather-edged seating in the chamber C. The bell being large is

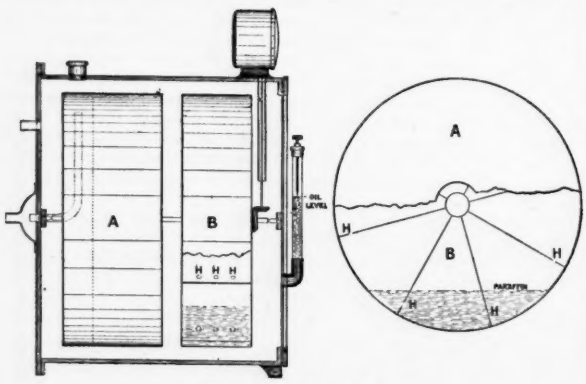


Fig. 8.—Gas Controller.

very sensitive, and the regulator will maintain a constant pressure at the outlet for large variations in the pressure of the gas supply. This particular form of pressure-regulator is not sensitive to tarry matter, which may deposit itself about the valve; and for this reason it can be used where a double dry governor would fail.

The principle of the controlling meter (fig. 8) is the regulation of the drum to a constant speed; and this is effected by coupling to the drum of the meter A a second drum B, which is divided into six or more compartments and contains a definite quantity of rectified paraffin. The flowing of the paraffin from compartment to compartment through the small holes H constitutes a definite brake to the rotation of the drum system; and when actuated by the steady pressure of the gas supply, the meter drum turns at a fixed speed, and delivers a uniform stream of gas, providing the gas is not appreciably restricted after the meter. It is important not to have the jet of the burner too small.

An improved controller of this class is being designed; and it is hoped that with this apparatus the gas stream will not appreciably alter for variations of 30 per cent. in the density.

The PRESIDENT said he should like to ask a question with regard to recording calorific power by the chimney. Was it not partially due to flame temperature? How did they with this instrument discriminate between flame temperature and calorific power. It seemed to him the temperature of the chimney would be raised by a gas of high flame temperature, which might not necessarily be a gas of high calorific power; for it was well known that the flame temperature of water gas (say, of 320 B.Th.U.) was considerably higher than coal gas usually sent out of 600 B.Th.U. Another point he was not clear about was how they shut off at a point where they did not record gross calorific power? How was a particular point fixed upon when the water vapour present came into play?

Mr. BRADBURY said he supposed he had not made it clear that the chimney responded not to the temperature of the flame, but to the quantity of heat units that were supplied to it; so that if in one case the temperature of the flame was greater than in another, so long as in each case the quantity of heat units were the same, the chimney would take up the same value, and would be the measurer of that. In other words, the chimney was the measurer of the heat units and not of the temperature of the flame. Since the gas was burned in a large supply of air, it would respond to the heat units actually dissipated in the chimney, and not to the temperature of the flame.

VOTES OF THANKS.

The PRESIDENT, before calling upon Mr. Hughes to propose a vote of thanks to the writers of the papers, expressed his personal thanks to them.

Mr. VINCENT HUGHES (Smethwick) said they had had three excellent papers that afternoon. In the first place, they had had a good description of the gas-boosting system, which was deeply interesting to them all. The second paper, by Mr. Stephenson, was on the slot-meter system, which was also interesting. The last, but by no means least, was the description of the recording calorimeter. In his own case, they had two calorimeters at the works—the Simmance-Abady and the Junkers; and they worked very closely together. The particular apparatus that was now before them, he had been waiting for for the last two years. The last inquiry he made brought the answer that the machine was not sufficiently perfect to put on the market; and he would like Mr. Beasley to tell them, if he would, if the instrument was now in order, and approximately the cost. The description they had listened to had been both interesting and lucid.

Mr. W. S. MORLAND (Gloucester) seconded the motion, remarking that he had been particularly interested in the paper referring to high-pressure distribution.

The motion was heartily agreed to.

Mr. BEASLEY, speaking on behalf of himself and his brother, said he should like to express their gratitude for allowing them to bring this invention before the members. Their best thanks were also due to the President, and to Mr. Bradbury not only for the paper, but for the valuable assistance he had rendered them with the calorimeter. He heartily thanked the members for their kind attention. The calorimeter had meant a lot of research and experimental work; but he thought now that it was a really good and valuable instrument. They could safely say now that they were getting the instrument into workable form, and that it would be put on the market at a fairly reasonable price.

Mr. WEBB, Mr. STEPHENSON, and Mr. BRADBURY responded in a few words.

THE INSTITUTION BENEVOLENT FUND.

The HON. SECRETARY (Mr. Meiklejohn) said it would be remembered that the matter of the benevolent fund of the Institution was taken up at the February meeting; but they had not had a meeting since at which a report could be made. The result was that, whereas in 1906, the Association had twenty members subscribing to the benevolent fund, and in 1907 only 25, they had at the present moment over 80. The increased amount subscribed since the February meeting totalled to £56 13s., which, with a sum of 25 guineas voted by the members in February, amounted to £82 18s. This included an item to which he should like to make particular reference; and perhaps he could best do this by referring to a letter received, in reply to his (Mr. Meiklejohn's) appeal, from Mr. Henry Hack, one of the Past-Presidents of the Association. In the course of the letter, Mr. Hack said:

I quite appreciate your efforts, and those of others, to increase the amount subscribed to the benevolent fund of the Institution of Gas Engineers; and I fully endorse your views that the amount subscribed by the members collectively is inconsistent with the large number of

the members. But I may mention that for a year or two, I have felt that, as regards myself, I would make amends in regard to the matter. I am writing to the Secretary of the Institution of Gas Engineers calling his attention to the fact that my contributions to the fund ceased at the time when the disruption took place in the then Gas Institute; and I am sending him a cheque, including compound interest, for the subscriptions over the period that has elapsed since that time. I hope that as regards my individual case it will be considered that I am not overlooking the claims of the fund.

In the £56 13s. was included Mr. Hack's cheque for £30. As the total subscriptions to the benevolent fund in 1906 were £97, he thought this £82 18s., which was nearly equal to the annual income of the fund, was good from the members of the Midland Association alone. The number of subscribers had been added to by members subscribing through their own Associations. The Manchester Institution had also taken the matter up as a district, and he had received a letter from Mr. Ruggles, the President of the Eastern Counties Association, saying that he made a special appeal at their last meeting, and realized £10, which had been forwarded to the Institution.

The PRESIDENT expressed the deep sense of the members' gratitude to Mr. Meiklejohn for his efforts in connection with this excellent fund; and he felt sure that these efforts had been greatly appreciated by the Institution. There was reason to be very well satisfied with the results.

This concluded the business proceedings; and shortly afterwards "high tea" was served.

MR. H. E. JONES ON LABOUR.

SIR GEORGE LIVESEY AND HIS GREAT WORK.

[An Address delivered to the Members of the London and Southern District Junior Gas Association, Oct. 23.]

Your President has very eloquently pointed out that you are meeting to-night under the shadow of a great affliction and a great separation. When I chose the subject for this address, which I communicated at the time to the President, and selected the question of Labour, I had not the faintest notion—no one had the slightest idea—that he who has been so properly called by the President the great captain of our industry was to fall in our ranks before I could give this address to you; nor could I foresee that the subject of labour would receive by that tremendous event a very special stamp and a very special importance. He was indeed a captain and a pioneer in labour; but he was something more. He was a liberator and an uplifter. He has done for labour that which has puzzled statesmen and politicians for centuries. His work has gone on to a greater extent even than I think he himself was aware of at the time he passed away. Owing to the present unsatisfactory conditions, the leader of a big shipbuilding yard in the North of England—Sir Christopher Furness—who found that a great many ships were being built abroad, has suggested as a solution of his difficulties, and of the loss of employment that was slowly and surely putting a stop to all progress, a scheme very much of the character of Sir George Livesey's. I could wish this news could pass the portals of the tomb, for it would have given enormous satisfaction to my late friend to see that this uplifting of the worker was extending into another sphere of labour altogether.

THE DIGNITY OF LABOUR.

To such an Association as this, it strikes one that labour must ever be a very leading question, apart from those general considerations which commend it to all thinkers. Labour was dealt with under the Mosaic tradition as a curse. I could never understand why, because from personal experience over some sixty years I have ever found it a blessing. So far from being a curse, I believe it to be a prayer. If you go to the great school of Rugby, you will find the motto is "Labour is Prayer"—*Laborare est Orare*. Labour is an immense comfort to any righteous, industrious man. It gives him dignity and a happy contentment. It improves his health; and, apart from this, it gives him that sturdy independence which is one of the finest features of the British character, and which tends to produce a self-respecting, upright citizen. No matter how mean the employment, a man who does his task to the best of his ability becomes dignified and worthy of respect. In the village where I live there is a tombstone testifying that the man lying there could thresh out more wheat with a flail than any other man in the neighbourhood. Again, the late Bishop of Oxford, addressing some ragged boys—bootblacks, they were—said that if he had happened to be a blacking boy, he would have made the boots shine more than any other boy. These examples show that there is room for pride in the very humblest avocations, if they be discharged with the righteous intention to do one's best.

WHAT IS AN ENGINEER?

After dealing with these general considerations about labour, and its satisfaction and its dignity, I would ask what are we in this Association? We call ourselves a "Junior Association of Gas Engineers." What does "engineer" mean? The word "engineer" is derived, I believe, from the French-Norman word *ingénieur*. There were two classes of engineers only, until a few years ago—the military engineer, who carved out the roads, and formed earthworks and fortresses for military operations, and the civil engineer, which included all other classes who pursued the more useful arts of peace. But in the French language, an officer of military engineers (*ingénieurs génie*) is called an *officier du génie*—that is to say, a man with genius or ingenuity for overcoming difficulties. Therefore we may take it that our title means we are ingenious people, who can do things, through our training and the sweat of our brains, or brow, a little quicker, a little cheaper, and a little better than a man not so trained. But our calling has been described in the Charter of the great Institution of Civil Engineers—the first Institution of the sort in the world, and on the Council of which Sir George Livesey was the first gas engineer to be elected—in words to this effect: "An engineer is a man who has to divert the forces of Nature to the use and service of man."

How can we as gas engineers consider that we are doing anything of that sort? Romantic as it may sound, it is absolutely correct science to tell you that the man engaged in gas engineering, and improving the different processes, is engaged in releasing the sunbeams which were imprisoned by the great trees grown ages and ages ago, which were afterwards covered up and compressed in the bowels of the earth, and became those geological formations which we are now taking up and turning into gas. So there is something dignified and something romantic in the work we do. But our work inevitably links us with this question of labour; and it is worth while to make a few general observations with regard to the attitude and the disposition of labour to us and of ourselves to labour, and our relations with the third element—which is that of capital.

THE NECESSITY FOR THE CAPITALIST.

Engineers are people who, having no money of their own—for we have very little—have to employ their brains in making employment for others. We have not the means or resources for carrying out the works that engineers do; and we are obliged to find the money which must go for the wages of the labourers—whether they are paid through a contractor, or whether we pay them direct—in the service of our undertaking. What have we to do when we want this money? We have to find the capitalist. What is the capitalist; and why in the name of common-sense do the leaders and the Labour Unions endeavour to treat him as if he were a hateful being—as if he were always the enemy of his employees, and must be treated altogether as an enemy, and have the least possible consideration and the least possible return?

Now, the capitalist is a man who has acquired money. But how? The original man had no money; he had to save, did the original capitalist. The man whose wants are few (and this reminds me of our dead friend), who leads a simple life, who, like the last Duke of Westminster, lunches off the merest trifle, and who never has elaborate meals of any sort; the man who has moderate needs (and I call to mind our friend's lunches, when he used to bring up in his pocket an apple and a slice of bread and butter, whereas other men in his position would spend half-a-sovereign on a bottle of wine or a lunch); the modest man with small requirements—he will inevitably accumulate the excess between what he obtains and what he spends. And the greatest benefactor to his fellow-men is not the man who spends freely on himself, but the man who produces more than he consumes. The latter must accumulate property; and if he indulged in the miserly spirit of simply pouring coins into a box or putting them into a hole in the ground, that money would do nobody any good. But naturally a man applies his savings in a manner that will be reproductive and bring him an income. Therefore the man who has got this money is the man we have to go to, and say: "I want to build a harbour, dock, railway, or gas or water works. I need your money."

The Nile dam had to be built by a great Engineer—Sir Benjamin Baker—with the help of a well-known capitalist, a man with money. They found a great Contractor—Sir John Aird—who received some of this money to pay wages and buy material. That is to say, a man who had saved money was first to be found. This work was carried out; and what did it do? It dammed up the Nile, rendered the desert fertile, and provided employment in the way of tillage for an enormous number of the Fellaheen labourers in Egypt.

I have given you that illustration; and I could keep you here all night with similar illustrations. I could point out that this process goes on everywhere; and the idea that, because the capitalist pays, and the labourer earns, the wages, therefore they must stand and fight with one another, is one of the most mischievous evil communications that ever corrupted the manners of many branches of workmen. It is a theory which brings strikes and disturbances of labour, and which led to our friend finding his solution, after a battle of a very strenuous character, which he won because he had righteousness on his side. He found a solution by which he helped the employee, and made him recognize his proper position—his proper duty to himself and his wife and children and his employer and the world at large.

We know if a man, no matter how humble his position, will restrain his wants and not be too self-indulgent, if he will be temperate and industrious, he will accumulate in a small way; and Sir George always had behind him the knowledge that, wherever his principle prevailed, it was fruitful. I myself could give instances; and Mr. Henry Austin knows of many. I had with me a family of three brothers who began as labourers when I was a young gas engineer at Wandsworth. One who lately died had the management of a Hertfordshire gas-works. He had saved about £9000; and he was at one time only a labourer—but that

was forty years ago, and during all this period he had been saving and doing his duty, and his employers were raising his salary and making him more comfortable, and giving him further opportunities of accumulating. A second brother at another works died worth £3000; and he had been only a man with 25s. a week. The third brother was unfortunately carried away by cancer many years ago; but he still left provision—in the shorter time afforded him—for his family. Cases might also be taken of men in the House of Lords whose forefathers began as working men; and there are many names among the nobility of England—or, at any rate, in high positions—whose bearers began in that way, but always with righteous industry and self-denial, and a disposition to work harder than was absolutely necessary to meet their bare needs. None of them consumed what they produced; and accordingly, by their industry and their intelligence, their savings increased, and they became wealthy capitalists.

In these days of political trifling with the working man, when he is told all kinds of smooth things, and vain promises are made to him by people who want his vote, anyone who will tell him this honest truth is his best friend, though he may be less popular with the workman than the deceiver who promises him bonuses from legislation which are impossible and illusory, or the blatant agitator who tries to excite his cupidity or his hostility by exaggerating the wealth of others, which, if they were despoiled of it, would enrich no one, but would cripple the industrial world. Sir George Livesey told them that truth—the unpopular truth—and fought a battle, and brought it home to them; and right well has he proved his words. He himself was an illustration of this truth—having small wants; but he had a royal heart where he could give, and was satisfied that the gift was going in a right direction. Gifts and charities given indiscriminately are most damaging; and nothing will undermine the character of the British workman more than leading him to expect extraneous benefit, when the sturdy independence of his own heart ought to be wisely helped.

LABOUR IN THE GAS INDUSTRY.

Now let us turn from labour questions in the abstract to our own case in particular, in relation to capital. We must bear the point in view. I myself, as an engineer, cannot understand how I could possibly get on with my works, unless I could find the man who had savings. A great deal is to be done by co-operation; but when starting a job workmen would want tools and appliances which they themselves could not find. I do think it is unfortunate that so little is understood of the righteous bearings of this question. I must not forget, however, that I am talking to practical men, who want to come to the practical work of their lives; and this brings me to the consideration of an aspect of labour which has been very popular of late years, and been run after probably more than it is worth—and that is labour-saving appliances.

Now if you consider that a horse power, by means of a steam or gas engine, can be obtained for something like 1d. per hour, and recollect that the smallest wages that we can give to a man is about 5d. per hour, you will see at once there is a rather captivating argument at first sight for displacing as many men as possible and using machinery. But it must be borne in mind that the installation of machinery means interest and depreciation, as well as wear and tear, upon a considerable outlay, and that it is in perpetuity. If machinery were too hastily adopted, it might soon mean that the plant had to be scrapped, with a sudden and inevitable loss of the money expended upon it. The expenses attending the "man with the wheelbarrow," so dear to Sir George Livesey, and, to go further, the "man with the horse and cart," are always to be arrested at short notice; and the capital sunk in these simple appliances—the wheelbarrow and the horse and cart—can be redeemed with very trifling loss.

It is equally true that there are very many processes which cannot be accomplished at all by the man and the horse and the wheelbarrow and cart, and that by means of suitable machinery things can be manufactured not only more cheaply, but in larger bulk, and with greater despatch, and can be even better finished, than by hand, unless very highly skilled and trained men are employed. But this general fact does not very much apply to our particular industry; and I will ask you to consider for a moment the problems in which we have to engage in dealing with the employment of labour. We have to receive and to store a large amount of raw material, some coming in large bulk, which needs despatch, and therefore calls for such an expenditure of power as can only be obtained by steam or gas engines. But if (owing to the smallness of the works) it should only arrive in truckloads or cartloads, obviously we must be careful in sinking capital in machinery which it cannot be hoped will be remuneratively occupied. Again, in conveying the raw material to the retorts, there is hardly any system which develops its full economy—of machinery, I mean—having regard to all the standing charges, unless it can deal with something like 300 retort mouthpieces for each machine. Obviously, therefore, we shall get little saving in works not employing that number; and when we consider that owing to the seasons varying, as we know they do unfortunately, in summer time probably not more than 30 or 40 per cent. of the maximum are being employed, then the possibility of a return is out of the question, because the machinery is largely idle.

As to the further question of machinery on a gas-works for quenching, storing, breaking, and delivering coke from the retorts, there the weight is so much reduced by the abstraction of the gases and liquid properties, and by the quantity of coke taken for heating the retorts, that there is seldom half the original weight of the coal to be dealt with; and this will be still further reduced when carburetted water gas is employed. Obviously here, again, remembering for how long a period in every year half the plant is idle, owing to the change of seasons, we have to be chary of sinking capital in machinery, especially in view of the depreciation and dilapidation which arise, not only from ordinary wear and tear, but from time and exposure to the weather. Moreover, unless the whole works have been originally suitably planned for it, the distributing and storing and loading of coke over the various areas occurring about the works renders any such system complicated and expensive. Here, again, we have to be careful of incurring fixed standing charges, &c.

For purification in the simple forms now necessary—and which simple forms are largely due to Sir George Livesey's help—there is very little labour involved. Condensation is in suitable closed vessels, and goes on naturally and automatically, whether by air or water contact. If we attend sufficiently to our condensation—which is very cheap and simple—the rest of the purification will further be rendered much simpler and much cheaper. The removal of ammonia needs but little labour—demanding simply the circulation of water over suitable surfaces in contact with the gas. Purification from sulphur in the form that is now necessary with oxide of iron may be considered as furnishing little room for machinery. If the material be revivified *in situ*—and it easily can be for the most part—it will not need removal more than two or three times before the whole power of the material is thoroughly absorbed. While on this subject, I will give you a hint that revivification by air must be done with air moistened with water vapour, which is best secured by a jet of steam. You must take care it is saturated with moisture, and you avoid all possibility of firing.

This brings one really to the end of the laborious processes in the manufacture of gas; and I think I have said enough as to the care needed in sinking capital in machinery. It may fairly be said that a great deal of machinery has been put into gas-works in consequence of the attitude adopted by labour. I believe that much money has been spent in this way. And here is the irony of the thing: The labour leader who agitated the men in the retort-house—that is where it generally took place—never saw that the ultimate result of his worrying would be that he would drive the employers into fitting up more machinery. To-day I should think I am well within the limit in saying that, relatively, there are not more than one-sixth part of the men employed in retort-houses that there used to be, because employers have preferred to put in machinery rather than be too much under their thumb. One direction in which labour does come in, and where machinery is quite out of the question, is in the great work of the outdoor departments of gas suppliers, owing to the stimulus given to the use of gas for heating and cooking and other purposes for which it was formerly employed very little. The outdoor departments now mean ten men where we formerly had one.

BETTER THAN LABOUR-SAVING MACHINERY.

But what is much better than labour saving by machinery are labour economies obtained by the saving of the waste of time and the prevention of the formation of dilatory, loafing habits (with the debasing results of lowering the men's self-respect), to say nothing of the withholding of duty bound service, known to the Unions as the "ca'-canny" method. The way to make a good citizen is to teach him the value of taking the higher course, and so prevent that degeneracy into the dejected, spiritless, loafing attitude which we see around us so much now in the shape of the so-called unemployed—because very largely unemployable. The vice of the age in regard to labour is that, since the workman has a parliamentary and municipal vote, he is perpetually being tempted with vain promises of extraneous and fortuitous aid in suggestions of legislative provisions for him apart from his own exertions and self-denial. Like Mr. Micawber, they are "waiting for something to turn up"—for "manna" to drop from the skies, as it did in the wilderness. Hardly anyone seems to have the courage to tell the men that these are idle promises, and are quite unworthy of their acceptance. Everything depends upon their own intelligent energies, exercised with manly truth and self-reliance, and followed up with prudent thrift and self-denial. If we are all in our relative spheres to do our duty by those working for us and beside us, we shall endeavour to instil this simple truth.

We had till a few days ago at our head one who had the sublime courage to enforce this lesson against tremendous odds, in the issue of a great strike which lasted many weeks and cost much money and great mental strain and anxiety to himself and those dear to him. After the battle was won, he saw that it was only to be the beginning of a noble crusade in the direction of putting power into the workman's own hands to teach himself the truth, and to illustrate in his person and that of his fellows that the success and profit, the independence and self-respect which he desired to bring about were to be an actual living experience, to be accomplished without either legislative coddling or fortuitous or charitable aids.

SIR GEORGE LIVESEY'S WORK AND CHARACTER.

I cannot close without a tribute to Sir George's other great achievements in aid of our industry. He suggested and brought in—and I am happy to say the Company I advised were the first to undertake it—the sliding-scale, which taught economy of capital, and of striving to lessen the cost of gas manufacture in order that gas could be sold cheaper. The effect of gas

being sold cheaper is that, where companies can reduce the price, business increases by leaps and bounds, as compared with places where the price is kept up. He saw that high illuminating power and the requirements of sulphur purification had made it impossible to manufacture gas so cheaply that we could meet the great want of a cheap fuel. Consumers now do not require high candle power. They want the heat—something they can burn in their grates and in their cooking apparatus. Thanks to Welsbach's invention, we obtain now the maximum light from the maximum heat; and therefore that consideration has gone. Sir George was always to the forefront taking care of our rights and our privileges. When companies were oppressed by undue rating, he was prepared to spend money, and he did spend it freely, to test this question and establish the rating on a better basis. Recently we had a decision of the Courts on the matter; and he found some of the money for fighting and putting the question on a more satisfactory footing. When he saw there was some danger of the Welsbach patentees getting too much control of the source of our mantles, he sent out an expedition and got his Company to find money so as to secure the necessary material to put us beyond the risk of failure of supply.

When the Eight-Hours Bill was brought up, he faced it at once; and one of the most dramatic scenes I ever recollect was when Sir George asked Mr. Gladstone, when we went as a deputation, what excuse there was for this Bill—what was the motive, because he saw none. Mr. Gladstone's answer was a comparatively insignificant one. He said: "This thing has been asked for so long that it is time something was done." It is obvious he was trying to catch votes. Again, I recollect a dramatic scene, when Sir George and the rest of us were arraigned at the Mansion House by the Coal Porters' Union. We had gentlemen interfering in what was a very simple dispute. The men were highly paid; but in spite of this Lord Mayor Isaacs, Cardinal Manning, Lord Avebury, the Governor of the Bank of England, and other well-known persons, were induced by the Secretary of the Coal Porters' Union to try and compel us unfortunate gas people, and others, to add another 2d. per ton to the wages. I believe the whole thing was claptrap, and there would not have been any strike even if we had refused; but the Lord Mayor, the Cardinal, and others, fell into the trap. Sir George resisted, and said: "There is no occasion for it; and I shall not give it." He had already got his strike over; and his men were in a better frame of mind. "But," said Cardinal Manning, "I have heard of you and your domineering ways. I have heard of the way in which you coerce the workmen." We all looked up. What could he know about it? Only what he had been told. Sir George replied, "Excuse me, Cardinal, I understand this thing a great deal better than you do." It had no effect on Sir George. He went back to his works, and gave no more money. But what happened to the rest of us? We were urged to fall in with an arrangement to give a rise temporarily, subject to an arbitration to be held subsequently to decide whether it should be permanent. Some of us fell into the trap; but though we asked for arbitration we never got it. Delays were frequent, until we found ultimately that we had a means of getting over the trouble. We put down grabs and big cranes; and then the men had to walk off. Again, I saw Sir George on the Labour Commission, where he asked some of the men's leaders extremely troublesome questions. One of them, when asked, "What is the object of reducing the time to eight hours?" replied: "To make employment for more people." "Suppose," said Sir George, "there are still unemployed people?" The reply was, "Then we will go to six hours." It was a childish remedy.

Sir George was very much occupied with his two Companies. We had him for some time on the Commercial Board, where we worked out a profit-sharing scheme under his guidance. He was not aware of it, but two other Companies I am connected with were ripening for the system. The Wandsworth and the Epsom Gas Companies have adopted co-operative systems very similar to his own, but not going quite the same length. This was the fruit of his work. The sliding-scale brought down the price of gas in the case of five companies I have been connected with by something like 1s. 6d. to 2s. per 1000 cubic feet, and raised the profits of shareholders—not in the same proportion, nothing like it, because it was only done by saving capital outlay, but it raised the dividends considerably, to the advantage of everybody. Then what followed? Because gas was cheap, people burnt it. I was on Beachy Head the other day with the Manager of the Eastbourne Gas Company (of which I am the Consulting Engineer), at the hour of cooking. We looked over the town; and we could not see a trace of smoke, so numerous are the gas cooking and other stoves the Company send out. I am wrong, there was one source of smoke—the chimney of the electric light works.

I have been talking about some reminiscences of the late Sir George. He was my friend 45 years ago. In those days many circumstances brought us much together; and Sir George was an illustration of another fact—that though we must all work and do our duty, we ought to have reasonable diversion. We shall do our work all the better if we have an occasional game of football, or something of that sort. Sir George had his diversions. He could swim, cycle, tennis, and golf. Then he was progressive. He tried a little motoring; and in connection with this, I may tell you something showing his courage. When his last illness was on, I went down to see him, and found that, though he had just left a bed of sickness, he was under his motor changing the tyres.

Now I want a final word or two. We are all working men, and are proud of being so. Sir George Livesey was a working man; and he worked to the end. There was a letter in "The Times" only about ten days before I heard of his being so ill, in which he warned the people that if they allowed the Port of London Bill to pass, they would find the same thing happen with the docks as had been the case with the Water Board—that the charges would be raised, and that the users would suffer very much. He always believed in self-help—in private undertakings and not in State aid. That was one of the most striking letters he ever wrote, because of the analogy he drew between what had happened with the Water Board and what would occur with the docks. Gas companies are now being asked to pay for their water, not at so much per 1000 gallons, but on the rateable value of the whole place; and this means that, instead of the 6d. per 1000 gallons imposed under the old Acts, they will have to pay about 5s. It is perfectly monstrous. Sir George Livesey warned people; and I think with justice. The Government have a right to improve the navigation of the Thames—that is national work; but it is not a national work to manage the docks.

AN EXAMPLE TO FOLLOW.

The day that Sir George took to his bed, he went to a hospital committee meeting at Reigate. Throughout his long career he was always hard at work. He was, of course, the leading Gas Engineer. You can each in your own sphere influence those with whom you work to follow his lead in introducing his self-help principle into your works. Let us extend, as Sir Christopher Furness has been trying to extend it, this principle of co-partnership and co-operation between ourselves, our employers, and our workmen. It will probably benefit ourselves. Sir George was wise enough to include the highest officers of the Company in his profit-sharing; and he advised the Commercial Company to do the same. Before I left the Company, I received some of it; and my son, who is now the General Manager, also gets it. So it goes all round. Sir George did not profess to do something for the working man and for no one else; he said all were entitled to it. Its effect is almost magical—for it is productive of good feeling, pleasant relations, and prosperity between employer and employed. Let us all go out from this meeting and this talk—which I fancy has been more about Sir George Livesey than any other subject—determined to further our dead leader's work, testifying our respect for him by our recognition of the truths which he taught, and by impressing these truths as far as we can upon those around us. Labour is dignified, honourable, and healthy. Any man who lays down his tools—lays down his work—as Sir George did, can leave this world with the comforting thought that throughout his life he did his best.

NATURAL & ARTIFICIAL PURIFYING MATERIAL.

Dr. L. J. Terneden, of Amsterdam, reported in the "JOURNAL" for April 14 last (p. 105) the results of comparative trials which he had made at the West Gas-Works, at Amsterdam, on Dutch bog ore and Lux purifying material. Apart from the question of the exhaustion of the supplies of the bog ore in Holland, Dr. Terneden was forced to the conclusion, from the results of the trials made, that the artificially produced Lux material possessed several advantages over the natural oxide; but he was not blind to its faults, which in the main arose from its extremely active character. While this activity is obviously a great advantage during purification, it is rather a disadvantage during revivification. To avoid firing the material, it was found necessary to wet it thoroughly immediately the lid of the purifier was removed. But the wetting had to be moderated to avoid the particles becoming stuck together when it was again used.

Since the publication of the article, there have been several communications on the subject in the pages of "Het Gas" and the "Journal für Gasbeleuchtung." Dr. Becker, of Frankfort-on-Maine, has emphasized the difficulties arising from the use of the artificial material, and Herr F. Lux has now dealt with the points raised by Dr. Becker. Briefly, it may be said that Dr. Becker has contended that the natural oxide continues to improve in efficiency on use, which is a contention controverted by Dr. Terneden's experience and likewise by the statements of Herr Lux. Dr. Becker also expressed a view that experience was lacking in regard to the use of the artificial material in works which had not cyanogen washers working in front of the purifiers; but Herr Lux points out that these washers have only been in use some eight years on gas-works (actually cyanogen washers have been in use at the Beckton Gas-Works for upwards of fifteen years), whereas the artificial material has been used for over thirty years on numerous gas-works. It is pointed out also that the risk of over-moistening the artificial material is not great, as not only is there evaporation of water during revivification, but also 0·3 lb. of water is taken up in the conversion of 1 lb. of sulphide of iron into ferric hydrate. Dr. Becker reported that, according to his experience, it was necessary to mix three to four parts of bog iron ore with one part of Lux material in order to obtain a mixture free from risk of ignition on revivification. Herr Lux, however, considers that one part of bog ore reduces the activity of three to four parts of Lux material to a sufficient degree. He points out that the Municipal Gas-Works at Vienna, and the works of the Imperial Continental Gas Association at Berlin, have used Lux material for many years without any admixture of bog ore.

WATER ACTS FOR 1908.

[Second Article.]

In the last number of the "Journal," the Acts obtained by Water Companies this session were noticed. We shall now deal with the proposals in regard to water supply contained in the Acts of Local Authorities.

The Ammanford Urban District Council Water Act confirms the works at present in existence, but does not sanction the construction of others, as required by the Bill. The limits of supply are the area under the jurisdiction of the Council; and the charge for water is to be 8s. 8d. where the rateable value of the premises supplied is less than £5, and is not to exceed 7½ per cent. per annum where it is less than £10, and not more than 7 per cent. per annum where it is more than £10, with the addition of a maximum of 5s. for each closet after the first, and of 7s. 6d. for each fixed bath capable of containing not more than 50 gallons. For all water supplied by measure, the maximum charge is to be 1s. per 1000 gallons. The Council may borrow for the purchase of lands in connection with the existing works any sum not exceeding £1700; such amount as may be requisite for paying the costs and expenses of the Act; and, with the consent of the Local Government Board, whatever further money may be necessary. Authority is given to the Llandilofawr District Council to borrow money to contribute to the cost of purchasing the land and obtaining the Act. The money borrowed for the first-named purpose is to be repaid within forty years from the date or dates of borrowing; and the costs of the Act are to be defrayed within five years from the date of the Royal Assent. [*Parliamentary Agents: Messrs. Bircham and Co.*]

The Audenshaw Urban District Council Act alters the constitution of the Ashton-under-Lyne, Stalybridge, and Dukinfield District Water-Works Joint Committee, and makes the Audenshaw Urban Council a combining authority; the union to take place as from March 25, 1909. The Council are to pay to the Committee in respect of capital contributed by the existing authorities prior to March 25, 1906, the sum of £43,000; and, in addition, one-sixteenth part of the further capital contributed between that period and the corresponding date next year. Further contributions are to be made in the proportions set out in a schedule to the Act. The borrowing powers of the existing authorities are to be diminished by sums equal to one-sixteenth of the amounts which they have been authorized to borrow, but have not raised. The other provisions of the Act refer to the improvement, health, local government, and finance of the urban district of Audenshaw. [*Parliamentary Agents: Messrs. Lees, Butterworth, and M'Donnell.*]

In a General Powers Act obtained by the Blackburn Corporation, there are three sections relating to the water undertaking, but only one of them calls for notice. It authorizes the Corporation to acquire lands for protecting their waters and water-works against nuisance, encroachments, injury, or pollution; and they are not to be deemed "superfluous" lands within the meaning of the Lands Clauses Acts or otherwise. [*Parliamentary Agents: Messrs. Tahourdins and Hitchcock.*]

The Blaydon and Ryton Water (Transfer) Act authorizes the sale of their water-works undertakings by the Blaydon and Ryton Urban District Councils, and confers powers of purchase upon the Weardale and Consett Water Company and the Newcastle and Gateshead Water Company. The first-named Company are to pay the Blaydon Council £6400, *plus* any amount expended by the Council, with the approval of the Company, in laying new mains within the limits of supply between Dec. 1, 1907, and Sept. 29, 1908—the day of purchase. The Newcastle Company will pay the Council £1600 and any sum spent on mains between Dec. 1, 1907, and Nov. 1, 1908—the date for the completion of the purchase. The Company will also acquire the plant of the Ryton Council for £2500, with a similar provision as in the other cases in regard to money spent on new mains between Dec. 1, 1907, and Nov. 1, 1908. The two Councils will sell a portion of their joint water-supply plant to the Consett Iron Company for £200, and the remainder to the Weardale Company for £500—both sums to be equally divided between the two authorities. On the completion of the various transfers, the obligations of the two Councils with regard to water supply will cease. The purchase-moneys are to be applied primarily in paying off any outstanding loans in respect of the water undertaking; and the balance, if any, is to be used for defraying the costs and expenses of the Act, or applied as the Local Government Board may determine. The Weardale Company are authorized to purchase lands specified, and the Newcastle Company to construct new works, consisting of a service reservoir in the parish of Ryton Woodside, in the county of Durham, and three aqueducts or pipe-lines in connection with it—to be completed within five years from the passing of the Act. Both Companies are empowered to make subsidiary works. Nothing is to prejudice or interfere with any right of the two Councils, under the Public Health Act, 1875, or otherwise, to provide or resume the provision of a supply of water in any part of their respective districts in which the Companies are not furnishing, or prepared on demand to furnish, a sufficient supply according to the provisions of their Acts. [*Parliamentary Agents: Messrs. Dyson and Co.*]

By the Briton Ferry Urban District Council Act, the Council obtain an extension of their limits of water supply, which are now to be the urban district and the parish of Baglan Lower, in the rural district of Neath, in the county of Glamorgan. The rates for the supply of water for domestic purposes are to be 6 per cent. per annum where the gross estimated rental of the premises supplied is less than £20, and 5 per cent. where it is above this rental; but the Council are not to be bound to supply any house or part of a house for less than 6s. 6d. per annum. For closets, beyond the first, up to 5s. each may be charged; and for a fixed bath, holding less than 50 gallons, not more than 7s. 6d. Supplies by meter are to be afforded at a price not exceeding 1s. 6d. per 1000 gallons; and bulk supplies on terms to be agreed upon. The Council are authorized to borrow the sum necessary for defraying the costs and expenses of the Act, and, with the sanction of the Local Government Board, such further money as is needed for any of the purposes specified therein. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Burnley Corporation Act authorizes the Corporation (*inter alia*) to construct additional water-works, consisting of a reservoir in the township or parish of Worsthorne-with-Hurstwood, to be formed by the formation of a dam across the Thornden Clough or Hurstwood Brook, two catchwater drains or conduits, five aqueducts, and diversions of a road and footpaths—all to be completed within ten years from the passing of the Act. The Corporation are empowered to appropriate the waters of the above-named brook, the stream known as Sheddon Clough, and all other springs, streams, and waters intercepted by the works sanctioned by the Act. Ample provisions are made in regard to the furnishing of compensation water, as well as for the temporary discharge of water into streams. The Corporation may borrow £215,000 for water-works purposes—to be repaid within sixty years of the time it is raised. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Bury and District Joint Water Board Act grants an extension of time for the compulsory purchase of lands required for works authorized by the Board's Act of 1903, and for their completion. For the lands referred to, the time is extended to the expiration of seven years from Aug. 14, 1908. The works mentioned in the Act are the Scout Moor high-level reservoir and the New Hall and Scout Moor reservoirs; and an extension of time to two years from the above-named date is granted in respect of the high-level reservoir and twelve years for the other two. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Conway and Colwyn Bay Joint Water Supply Board Act confirms the construction of the existing water-works, but does not authorize the carrying out of the subsidiary works included in the Bill. The Board may draw from Lake Cowlyd all the water they require for the purposes specified in their Provisional Orders of 1891, 1896, and 1898, as well as in the Act; but they are to discharge into the Afon Ddu not less than 1,364,000 gallons of water in a continuous flow every 24 hours. In the Bill, provision was made for the Board to enter into an agreement with the Council of any of the constituent districts for taking over the management of the distribution of water within the area of such Council or part thereof, and exercise all or any of their powers in relation thereto; but no such authority is given by the Act. Provisions which were not in the Bill are, however, contained in the Act, for the protection of the Aluminium Corporation, Limited; the Board having to discharge from their existing gauge-chamber into the main stream of the Afon Ddu from Lake Cowlyd not less than 1,552,500 gallons of water every day in a continuous and uniform flow. If the Corporation are injuriously affected by the powers conferred upon the Board by the Act, they are to be entitled to full compensation, as provided by the Water-Works Clauses Act, 1847, or any amending Act. Out of their compensation water, the Corporation are to provide a sufficient quantity, unpolluted, for watering cattle and for agricultural and domestic purposes, in the portion of the Afon Ddu which abuts upon the Dolgarrog Estate of Mr. George Cooper. [*Parliamentary Agents: Messrs. Chamberlain, Johnson, and Hartopp.*]

In the Bill promoted by the Glyncorrwg Urban District Council, power was sought for the construction of additional works; but this portion of the Bill does not appear in the Act. The only point for notice is a section dealing with the rates for the supply of water. It is set forth therein that where the rateable value of the premises supplied does not exceed £12 a year, not less than 4s. 4d., nor more than 8s. 8d., per annum may be charged; but where it is above £12, the rate is to be 5 per cent. per annum. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Huddersfield Water Act makes provision with regard to the discharge of compensation water from the works. Section 29 of the Act of 1869 is amended in respect of the total quantity of water—viz., 156,960 gallons—required to be discharged daily into the Hoyle House Clough; and in the Act provision is made that six-sevenths of it is to flow in, in equal quantities per minute, between six in the morning and six in the evening, and the remainder between the latter and the former hour. The occupiers of the Hoyle House Clough Mill may, however, require the relative proportions of the day and night flows to be varied; and they are to bear the expense entailed by these provisions. Similarly, section 26 of the Act of 1890, and section 14 of the Act of 1902, are amended in respect of the compensation water discharged from the Butterley reservoir into the Wessenden Brook—viz., 2,258,640 gallons on each ordinary working day, and 1,129,320 gallons on Saturdays. In this case also it is enacted that six-sevenths of the total is to be the day flow and the remainder the night flow; but the mill occupiers may require the proportions

varied, and they are to bear the expense occasioned by the new provisions. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Keighley Corporation Act confers upon the Corporation power to purchase additional lands, not exceeding 2000 acres, in connection with their water undertaking, and extends the time for the construction of certain works. The period limited by the Act of 1898 for the completion of the Bully Trees reservoir and other works is extended until the expiratian of ten years from the passing of the present Act (Aug. 1, 1908). But within two years from now the Corporation are to substantially commence the construction of these works; and if they fail to do so their powers in respect of them are to cease. The Corporation have been authorized to purchase by agreement the freehold of the Calversyke, Highfield, and Lower Castle Mill reservoirs, now held on lease, and to make arrangements with the Bradford Corporation for obtaining a supply of water in bulk from them for use in Keighley. The charge for water in future is to be based on the rateable value, instead of, as hitherto, on the annual rack rent or value of the premises supplied. Any deficiency in the water revenue is to be made good out of the district fund, and the next general district rate is, if necessary, to be increased to meet the extra demand upon the fund. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

INCREASED WATER STORAGE FOR LONDON.

Commencement of a Large Reservoir at East Molesey.

WHATEVER decision the Metropolitan Water Board may come to on the question of resorting at some future time to distant sources for the supply of water to London, they are determined for the present to utilize to the fullest possible extent those which are near at hand. Evidence of this has been afforded on two occasions in the past six months. In the "JOURNAL" for the 14th of April, we reported the proceedings at the ceremony of cutting the first turf for a reservoir at Chingford, to contain 3000 million gallons of water, to be drawn from the River Lea and the Lea Navigation; and to-day we have to record a similar function in connection with another reservoir—only, however, one-third the size of that just referred to—to be constructed at Island Barn, East Molesey, and to be filled from the Thames. These two works were really projected by the East London and Lambeth Water Companies respectively; but their execution was passed on to the Water Board on the transfer of the undertakings. An interesting item in the programme for Saturday's proceedings was the laying of the foundation stone of the new engine-house at the pumping-station in connection with the Knight and Bessborough reservoirs at Walton, which were both completed in the spring of last year.

To take part in the last-named ceremony, only the members of the Works and Stores Committee of the Board and representatives of the Press were invited; and they left Waterloo Station about one o'clock. On arriving at Hampton Court, they were conveyed to the site of the engine-house, which is at the south-west corner of the old Chelsea Company's reservoirs, and on the north side (exactly between them) of the two Walton reservoirs above referred to, from which it is separated by the public road. The assembled party included the Chairman and Vice-Chairman of the Board (Messrs. E. B. Barnard, M.P., and G. S. Elliott, J.P.), the Chief and Deputy Chief Engineers (Messrs. W. B. Bryan and J. W. Restler), and Mr. Flett, one of the Directors of Messrs. Dick, Kerr, and Co., the Contractors for the pumping-station. In the course of a brief speech, Mr. Barnard remarked that the Board had always been fortunate in the selection of the firms for carrying out their contracts; and, judging from what he knew of the one to whom the work now to be commenced had been entrusted, he felt sure that it would be executed in a thoroughly satisfactory manner. He then asked the Chairman of the Works and Stores Committee (Mr. C. E. Hearson) to lay the foundation stone of the new house. A silver trowel having been handed to him as a memento of the occasion—for which he expressed his sincere thanks—he proceeded to comply with the request. Having deposited in a cavity formed in the bed upon which the stone was to rest a hermetically sealed bottle in which had been placed a copy of last Thursday's "Times," a pocket-book containing the names of the members of the Board, and a *brochure* furnishing particulars of the works with which the day's ceremonies were associated, he performed, with assistance, the necessary mortaring operations, the stone was lowered to its resting-place, and he declared it to have been "well and truly laid."

The party were then conveyed to the north side of the site of the proposed reservoir at Island Barn, where the members and officials of the Board and a number of invited guests, who had left London by special train early in the afternoon, were received by the Chairman and Vice-Chairman of the Board and the Chairman (Mr. John Lidiard) and members of the Reception Committee. Special interest attached to this gathering, which was a numerous one, from the presence of the President of the Local Government Board (the Right Hon. John Burns), who had been announced to deliver an address. The party having assembled in a marquee, Mr. Barnard took the chair, having on his right Mr. Elliott and on his left Mr. Burns. On the invitation of the Chairman, Mr. Hearson gave some particulars in regard to the reservoir he was about to inaugurate, which, he said, had been re-designed by the Chief Engineer. He laid stress upon the great advantages, from the point of view of the purity of water, attending adequate storage, inasmuch as the more they had the less filtration was required. He called attention to the fact that since the Board had had control of the water supply of London additional storage to the extent of 4530 million gallons had been provided, and that another 4700 million gallons had been arranged for. He thought the present work would be a credit to the Board, who had been liberally met by their Contractors. The Chairman next called upon Mr. Burns, who delivered a long and interesting address. He expressed his great pleasure at attending, not only in his capacity as President of the Local Government Board, but as the Water Board's official guide, their vigilant financier, and—might he add?—their municipal friend, the inauguration of a great, necessary, and useful public work, which would be the means of putting employment into a number of hands; and he highly commended the action of the Board in, so to speak, ante-dating the work with this object. He said this was a new and unique feature in connection with their operations; and it was mainly responsible for his visit. It symptomized, so far as he was concerned, a new spirit in the municipal bodies of Great Britain. It was the beginning of what he hoped would become the conscious ordering by civic society of its industrial aims, and the disciplined adaptation of public works in their execution to private trade depression, and through both to the provision, at the proper time, of useful work for the genuine unemployed, and the alleviation of human suffering. He was sure all present hoped and believed that the work begun that day would be well finished; and he trusted that when he came—as he hoped he might have the honour of coming—three years hence to take part in its completion, they would all be able to say to Mr. Bryan, Mr. Restler, the Contractors, the foremen, and the navvys, "Well done, good and faithful servants." The rest of the address consisted of a definition by the right honourable gentleman of his attitude towards the question of unemployment generally; and he concluded by making a very powerful appeal to public authorities to so organize their works of utility that they could be carried out in times of depression in trade, rather than when there was an all-round demand for labour.

The address was most cordially received. At its close, the company proceeded to the spot on the reservoir site selected for the turf-cutting operation. This was performed by Mr. Hearson, who, as customary, was presented with a silver spade in memory of the occasion. He did not, however, use it, but an ordinary one, in cutting and barrowing a few turfs; in which work he was followed by Mr. Burns, who accompanied his act by wishing the Board "good luck" with their reservoir. Hearty cheers were then given for the Board and Mr. Burns, and the party returned to the marquee. The remaining business consisted in thanking Mr. Hearson for performing the two ceremonies of the day, to Mr. Barnard for presiding, and to Mr. Burns for identifying himself with the work by his presence. All three gentleman briefly replied, and the proceedings closed.

Light refreshments were served in the marquee; and the company were conveyed to Hampton Court Station, whence they returned to London by special train.

Particulars of the Reservoir and Pumping-Station.

In the year 1900, the Lambeth Water Company obtained an Act of Parliament authorizing the construction of a reservoir, designed by their Engineer (Mr. T. F. Parkes) to hold approximately 1000 million gallons; and the necessary land was acquired. After the undertaking of the Company was acquired by the Water Board in 1904, the area of supply was incorporated with that of the Southwark and Vauxhall Water Company; thereby forming what is now known as the Board's southern district. In its Various Powers Bill of last year, the Board applied for an extension of time for the construction of this reservoir, but met with considerable opposition. An extension of seven years was, however, obtained; but the area of the reservoir was to be curtailed, and the design otherwise modified to meet objections raised by the local authorities.

On its completion, the reservoir will be used not only for the southern district but also for the Chelsea division of the western district. It will contain nearly 1000 million gallons, and will have a water area of approximately 120 acres. The embankment will have a length of $1\frac{3}{8}$ miles, and will consist of about $1\frac{1}{4}$ million tons of earth taken from the inside of the reservoir. The water to fill the reservoir will be drawn from the Thames; a portion being delivered through the existing 54-inch southern district and 36-inch western district mains, both of which at present supply the filter-beds at Surbiton from the intake works at Molesey. A further quantity will be delivered from the Walton pumping-station through a 54-inch main, about $1\frac{3}{8}$ miles in length, which is to be laid down as part of the new works. After storage, the water will pass to the filter-beds at Surbiton through one or both of the southern district or western district mains. These works will be so constructed that the mains in the future can be used either for discharging into the Island Barn reservoir or for supplying water from the reservoir to the filter-beds at Surbiton, or, as a further alternative, for delivering water direct from Molesey to Surbiton.

For the construction of the works, about 112,000 cubic yards of puddle clay, 6350 tons of cement, 2500 tons of cast-iron pipes, and 550 tons of steel pipes will be required, besides other materials.

The contract for the reservoir, the 54-inch main, &c., has been given to Messrs. Robert M'Alpine and Sons; the amount of their tender being £152,727. The works, which have been designed by the Chief Engineer of the Board (Mr. W. B. Bryan, M.Inst.C.E.), should be completed in about three years.

The water supplied from the Walton pumping-station is conducted to the pumps from the Thames through an open conduit, 480 yards long, 22 feet wide, and taking 8 feet depth of water when the river is at its normal level. The engine and pump house is built over the conduit, from which the water is lifted into either the Walton reservoirs or the one at Island Barn by four double-stage centrifugal pumps, each being driven direct by a 500-H.P. vertical triple-expansion engine. The steam is generated by ten Babcock and Wilcox boilers. The discharge from the Walton reservoirs to the filter-beds at Hampton is used to actuate three hydraulic turbines, which are coupled direct to single-stage centrifugal pumps—thus allowing the difference of level between the water in the reservoirs and that in the filter-beds to be employed in lifting a further supply of water into the Walton reservoirs. The engines, pumps, and turbines are being supplied by the Thames Iron-Works and Shipbuilding Company, and will cost £49,653. The contract for the intake conduit and pumping-station buildings has been let to Messrs. Dick, Kerr, and Co.; the contract price being £69,657. The pumping-station, machinery, and intake works at Walton were designed by Mr. J. W. Restler, M.Inst.C.E., the Deputy Chief Engineer of the Board.

USE OF TAR ON ROADS.

The International Road Congress in Paris, to which reference has already been made in the "JOURNAL," was brought to a successful close on the 17th inst. Altogether, 98 papers were contributed; about one-fifth of them coming from England. Those in which our readers are specially interested dealt with the use of tar for surfacing roads, with a view to the prevention of dust; and to some of these we shall refer as occasion serves.

Commencing with the paper by Mr. H. P. Maybury, the Engineer and Surveyor for the county of Kent, who, it may be remembered, was a few years ago the Surveyor and Gas Manager to the Great Malvern Urban District Council, the author stated that since 1905 many experiments had been carried out in order to ascertain the best and cheapest way of making strong and dustless roads; among them being the laying of tarred macadam, the use of blast-furnace slag impregnated with tar, and of blue Norwegian granite laid dry, well rolled, and grouted in with heated distilled tar and granite chippings, and the treatment of ordinary macadam surfaces with heated tar. He said sufficient time had not elapsed to enable him to frame a reliable estimate of the respective values of the different systems; but he was clearly of opinion that strongly-made roads with hard granite surfaces, well rolled and bound down with clean, hard flint gravel and granite chippings, and afterwards treated with heated tar—using about a gallon of tar to each 6 superficial yards of surface—would be extremely difficult to beat, when considered both as to first cost and as to durability. Tarred macadam cost, on an average, 3s. per superficial yard laid complete, against 1s. 6d. for the best hard granites tar-painted; so that to justify the use of the former it must be possessed of double the life of the latter. Tarred macadam was by no means dustless; and in the author's experience it had been necessary to dress the surfaces each year with tar, just as though ordinary granite had been used. While tarred macadam roads were excellent for ordinary light motor traffic, the author found that they did not afford such good foothold for horses, nor were they so solid to support traction-engine and heavy motor traffic as the hard granited and tar-painted surfaces.

In the author's county, in the year ended March 31, 1907, a sum of £4000 was expended on tar alone; some 153 miles of rural main roads having been dressed with this material, much to the comfort of users and residents adjacent thereto. During the present year they are extending the scope of their operations, and will shortly have covered one-third of the rural main roads in the county—say, 200 miles. The tar, in addition to effectually laying the dust, has the property of holding the surfacing materials together, preventing movement, and thus disintegration; and the author is most hopeful, notwithstanding the great expense now being incurred, that in the next two or three years the benefit of the use of tar will be apparent upon the right side of the financial returns.

For the immediate future, Mr. Maybury is of opinion, as the outcome of experiment and experience, that a sure and certain way of improving and fitting roads for the new traffic upon them is: (1) To build them up as strongly as possible, reducing the camber to a uniform 1 in 30; (2) coat the surface with the best obtainable hard material, broken to a gauge of not less than 2 inches and not larger than 2½ inches, well rolled and consolidated, only clean hard gravel and chippings being used as the binding agent; and (3) well clean the surface, and apply a dressing of heated tar compound, covering it with hard, clean gravel or granite chippings, and well rolling with a steam-roller. Such a surface is the cheapest to construct, is almost dustless, provides good travelling for traction-engines and commercial motors, and is the least slippery for horses. He is by no means satisfied that any other method, even though at double the cost, would be quite so satisfactory for all kinds of users as that set out above.

Mr. H. T. Wakelam, the County Surveyor of Middlesex, contributed a paper on road surfaces and tarring. He remarked that in the last ten years there had been seen marvellous developments and changes in motors and tractors; and there was no doubt that, with the further increase in mechanical traction which might reasonably be expected, a still greater request would be made for better carriageways. How to meet this extraordinary traffic was a problem not only for the road engineer, but also for those who had charge of the finances of road authorities generally. An expenditure of something like £50,000,000 would be necessary to resurface the rural main roads of England and Wales alone with tarred slag or limestone, and probably a much greater amount if tarred basalts or granites were used. To raise such a sum under the present system of British local taxation was practically impossible. To obtain reliable information as to the lasting qualities of macadam, the author expended about £2500 in the summer of last year in laying experimental surface lengths, both tarred and untarred, along portions of a main road leading out of London. The sections marked out for the experiment were selected to obtain results under (1) the same traffic conditions, (2) the same atmospheric and wind conditions, and (3) the same labour conditions. The cost of the experiments worked out at about 4s. per square yard, which would involve an expenditure of some £57,596,560 if the whole surface area of the rural main roads in England and Wales alone were covered with the same materials. Six different treatments were adopted, and all the six sections were standing fairly well. From weekly observations of the general wear and tear, it was probable that the ultimate order of merit would be as follows: (1) Tarred granite and limestone chipping matrix; (2) tarmac; (3) tarred granite and limestone mixed; (4) untarred granite; (5) tarred limestone; (6) tarred flints and limestone chipping matrix. There was a greater degree of disintegration with the latter than with any other section.

Mr. T. Aitken, the County Surveyor of Cupar (Fife), presented a paper on "Macadamized Roads Suitable for Modern Traffic." He said that there could be no question that when a road was properly treated with tar, or a like composition, apart from the suppression of dust, the life of the road was increased and the cost of tarring amply repaid. Tarring roads was the cheapest system for dust prevention, providing the tar was distilled, of good quality, and properly applied. Treated roads combined many of the advantages of asphalt, were practically waterproof, afforded a good foothold for horses, and were comparatively noiseless, while the cost of scavenging was lessened. The cost of surface spraying varied within certain limits, depending on the price of tar, the quantity used, and other circumstances; but it might be taken as ¾d. to 1d. per square yard of road treated.

Reviewing the proceedings at the congress, the special correspondent of "Nature" says: "On a matter of common interest—that is, the substitution of tar or bituminous binding material in place of the water hitherto used to consolidate and hold together the road material, which is conveniently dealt with under the French name, *goudronnage*—the congress practically gave a unanimous answer. This was to the effect that if *goudronnage* is properly carried out—if the tar or similar material is chosen with reasonable care to avoid matter soluble in water, such as ammoniacal liquor, remaining mixed in the tar so that it can be subsequently washed out by the rain or dried out in the form of crystals which might afterwards form an irritating dust; if the tar is put on in the correct quantity, and this quantity the smallest required to hold the individual stones of the road metal firmly in position, so that they never roll or move in relation to one another, and their upper surfaces are allowed to wear themselves bare of tar—it is not a difficult matter to obtain, at quite a moderate expense, a waterproof road which will not do any damage to vegetation, which will be practically dustless if it be swept at reasonable intervals from horse droppings or dust blown upon it from the adjoining land, and which need not be slippery, either to horse or automobile traffic, whether the surface be wet or dry. . . . It had been asserted that tar was a palliative, but that, on the whole, its defects were greater than its advantages. Those who were present at the congress know that this is an incorrect statement; that such damage as has occurred to trees and vegetation, or inconvenience to passengers, such as irritation of the eyes and throat, which followed on the early applications of tar to the French roads during the Grand Prix race, was due to well-understood causes—that is to say, to the use of crude tar and its application to a road surface which had already broken up. Both of these faults the congress unanimously condemned."

The International Commission on Reinforced Concrete recently met in Bâle, under the chairmanship of Professor Schule, of the Zurich Technical College. There were present representatives from all the important European countries. The work of the Commission is divided into four sections: (1) The preparation of a summary of tests completed in different countries; (2) a summary of the facts definitely established by these tests; (3) a summary of the chief causes of difference of opinion on questions relating to reinforced concrete; and (4) the preparation of a set of standards for future tests. The first part of the work will, it is hoped, be completed in time for a report to be presented at the meeting to be held in Copenhagen next September.

HIGH PRESSURE DISTRIBUTION.

By CHARLES H. WEBB, M.Sc., Assoc.M.Inst.C.E., of Stourbridge.

[A Paper read before the Midland Association of Gas Managers, Oct. 22.]

The purpose of the author is to describe the plant for distribution of gas at high pressure installed at Stockport some four years ago—giving the reasons for the selection of the system, the method of working same, and a few remarks prompted by the experience gained. An increase of distributing plant was necessitated by the extremely rapid growth of a residential village at the end of a trunk main; and as in the winter, with a pressure at the station governor of over 4 inches, only about 1 inch was obtainable at the village, something had to be done during the following summer to remedy this state of affairs.

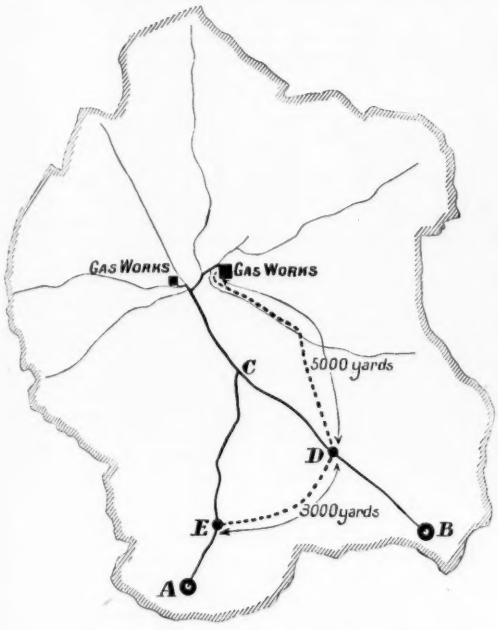


Fig. 1.—Area of Supply with High-Pressure Main.

Three methods were considered; the first being that of increasing the trunk main from the works. The advantages are simplicity and centralization of control by the station governor; the objections being the great difficulty and expense of laying large pipes in narrow, tortuous streets paved with concrete and setts, with electric trams running on them, and the subsoil already crowded with gas and water pipes, cables, and sewers.

The second scheme considered was the erection of a small gasholder at or near the village. This has scarcely anything in its favour. Suitable land would have to be obtained, in a position where the holder would not be an eyesore to the residents; an attendant would be required to look after the filling and discharging, and to prevent freezing of the water in winter; and capital outlay would also be heavy. Thus the idea was very soon abandoned,

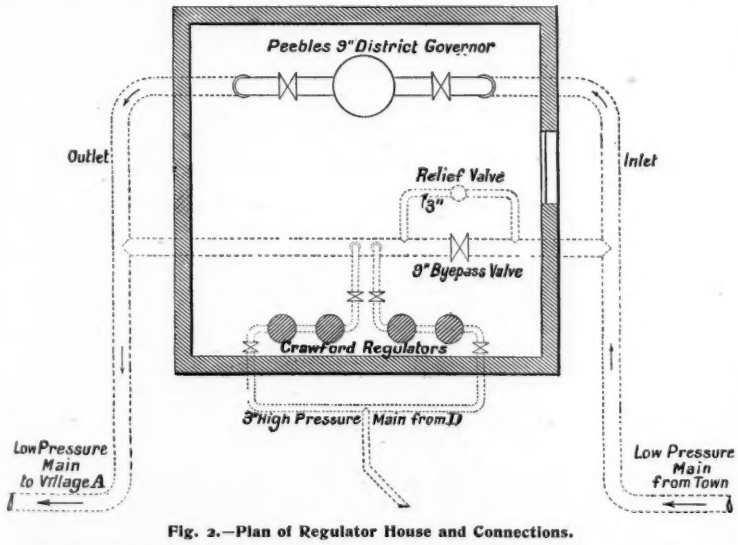
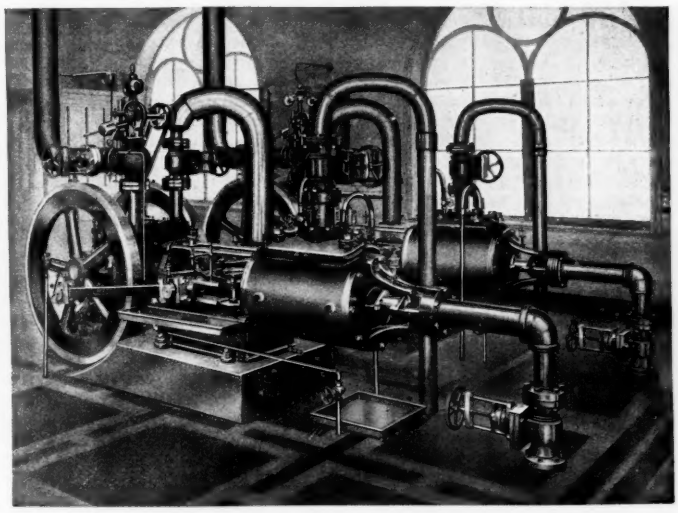


Fig. 2.—Plan of Regulator House and Connections.

The third method, by using a high-pressure system, was then investigated; and calculations showed it would be much cheaper to instal than either of the other two, even for an outfit of much higher capacity than was required for the immediate demand. It could also be arranged in such a way as to form the first part of a scheme for a high-pressure ring-main round the area of supply to feed into the other trunk mains as required later. As a large delivery can be obtained through a small pipe by this system, it is not so important to choose the shortest route if one more convenient, but somewhat longer, can be found—the extra cost being slight. On the other hand, there is the continuous expense of compression, which, though small, is still appreciable; and also the fact that a portion of the controlling apparatus, needing frequent inspection, is situated at a distance from the gas-works.



The Ingersoll-Rand Company's Compressors.

After full consideration, however, the Engineer (Mr. S. Meunier) recommended the high-pressure system; and the Gas Committee decided on its adoption. A glance at plan No. 1 will show that the village previously referred to (A) is at the end of a main, which some distance back, at C, springs from the main leading to another village (B). The manipulation of valves near the point C was tried with the idea of checking the flow to B, and thus allowing more gas to go to A. But experiments proved that, even if the supply to B was reduced to the lowest limit permissible for satisfaction to consumers, little improvement could be noticed at A. It was decided to lay the high-pressure main by a fairly direct route through quiet streets and lanes to intersect the main roads to both villages A and B; so that the supply of gas to either or both of them could be improved as desired.

About 5000 yards of 4-inch diameter Mannesmann steel tubes (shown by dotted lines) were laid to a point D, and there divided into two 3-inch branches—one of which was prepared for connection to the low-pressure main at D, and the other was continued to E, a further distance of about 3000 yards. Although a regulator pit was constructed under the foot-path at D, with all necessary connections, valves, ventilating shaft, &c., it has not yet been brought into use, as the supply at E has met all the requirements up to the present. The distance from E to A is about three-quarters of a mile.

Full information as to the main itself having been given in a paper read by Mr. J. Alsop, the Chief Draughtsman at the Stockport Gas-Works, and published in the Technical Press in February 1905,* it is not proposed, to give any description here, except to mention that stop valves and pressure-gauge boxes are fixed at intervals of one mile for testing purposes; and syphons, of course, as required. Two compressors were supplied by the Ingersoll-Rand Company. They are horizontal, direct-coupled, water-cooled, and will each compress 24,000 cubic feet of gas per hour to 25 lbs. pressure (with steam at from 40 to 50 lbs.). The steam, exhaust, suction, and delivery stop-valves are of Hopkinson's make. Combined speed and adjustable pressure governors are fitted. The compressors are very suitable for the purpose; and up to now no repairs whatever have been required. They are situated in the exhauster-house, and are driven by the exhauster man—no extra labour being necessary, except harder firing by the boiler man when the compressor is running. The gas taken from the holder outlet is delivered by the compressor to a receiver, which was made from an old

* See "JOURNAL," Vol. LXXXIX., p. 491.

Cornish boiler purchased for a few pounds, and erected on end in a corner of the purifier-house. From the receiver, the gas is sent through a Foster reducing valve (made by Messrs. Bailey and Co., of Salford), such as is commonly used in sulphate of ammonia plants, into the line at a somewhat lower pressure. [For simplicity, the word "line" will here be used for the high-pressure main.] This valve ensures that the line-pressure is constant, and forms a small reserve in the receiver; so that the compressors can be changed without any fluctuation or drop of pressure occurring.

The method of working the plant is as follows: Just before dusk, or at any other time of heavy consumption, the compressor is started, and races at its maximum speed (about 150 revolutions per minute), being kept in check by an ordinary ball governor. As the pressure rises in the receiver and line, a pressure-operated governor on the engine comes into action, and reduces the speed (by throttling the steam) to that required to keep the pressure in the receiver at the desired amount—say, 25 lbs.; the reducing valve to the line being set at 20 lbs. If there is no consumption at the village, the pressure governor continues to reduce steam till the speed is at a minimum, controlled by an adjustable stop-screw on this governor. Then, naturally, even at this slow speed, if there is little or no consumption, the pressure would rise in the receiver, and does so slightly (say, up to 28 lbs.), when an enclosed safety-valve on the receiver and adjusted to this figure begins to blow, and returns the excess gas through a small pipe to the holder inlet-main. As the consumption increases, the pressure in the receiver drops, the safety-valve ceases to blow, and the pressure tends to fall further; and the pressure governor then allows the engine to speed sufficiently to maintain the receiver pressure of 25 lbs. This would go on until the maximum speed and delivery of the compressor were reached, when the ball governor would act. The gas is thus sent along the high-pressure line to the regulator-pit at E and passed through the Crawford regulators (which are in duplicate sets) into the low-pressure main.

The apparatus was completed, put into use, and worked most successfully, except that the compressor constantly ran at a higher speed than had been anticipated. It was discovered eventually that from E gas was flowing both ways in the low-pressure main; so that, in addition to supplying village A, the high-pressure main was sending gas towards the town, and thus lightening the work of the station governor at the gas-works. As this was wasteful, the regulator pit at E was removed, and instead a shed was erected in a field by the roadside, pipes led to it, and apparatus installed as shown on plan No. 2. This arrangement is now working satisfactorily, and is as follows: The 9-inch low-pressure main from C to A was cut, and led into the shed, and connected with a 9-inch Peebles district governor (underground type) with inlet, outlet, and bye-pass valves as shown. The Peebles governor is set to give an outlet pressure of about 28-10ths, or 2-10ths less than that given by the regulators from the high-pressure main (30-10ths). In the daytime, when the high-pressure system is shut down, the village A is supplied from the low-pressure main through the Peebles governor. When the compressor starts, the regulators begin to deliver at 30-10ths, and thus there is a greater pressure on the outlet of the Peebles governor than it is regulated to give. Therefore it closes, and the supply to A is obtained wholly from the high-pressure main. The various pressures given above are, of course, to be varied to suit different requirements; but the differences or margins mentioned may be taken as the amount needed to cause the apparatus to operate with certainty.

The Foster reducing valve can be easily and quickly adjusted to give outlet pressures varying between 30 lbs. and 5 lbs., and should only be set high enough to give a few pounds pressure at the end of the line just before the Crawford regulators, so that they shall not be overtaxed. Keeping the line pressure as low as possible also reduces leakage.

If from any cause the high-pressure supply should fail, the pressure on the outlet or village side of the Peebles governor would fall until it opened, and gas would pass forward from the station governor and the low-pressure main. This would not give a proper supply, but only sufficient to prevent the village being entirely in darkness; and the high-pressure delivery could be renewed as soon as the defect was remedied. If the compressor is started when there is no demand, and the Crawford regulator should fail to act, or allow gas to leak through, then a relief-valve (set at about 4 inches of water pressure) takes the gas over to the inlet or town side of the Peebles governor, and simply causes the station governor to supply less gas; and since the maximum delivery of a compressor is far less than the minimum delivery through the station governor, the pressure in the town mains can never increase to any great extent. A Bristol recording gauge is kept at a shop in the village, and for a small fee the shopkeeper changes the papers daily, and posts to the works the one taken off each morning. It is received in the afternoon; so that before starting the compressor the result of the previous day's working can be seen.

The experience gained while running the plant for a short period, before the author was appointed to Stourbridge, prompts some observations which may be of interest. Cast-lead joints are not satisfactory, and should not be used on this work. Screwed joints, or some of the special couplings such as the "Dresser," &c., used in America, would, it is believed, be much more suitable, especially with expansion joints inserted at intervals. Perhaps, also, lead-wool might give good results.

Reduction in illuminating power need not be feared with qualities of gas as usually supplied, although no doubt there might be some loss in the case of a very rich gas. At Stockport, on the contrary, simultaneous photometrical tests at the gas-works and the village have shown that the illuminating power is actually increased—probably due to the removal of water vapour from the gas by compression. This is important in another way; the meter inspectors reporting soon after the plant was put into use that the wet meters at the village required much more water than before. The tendency to slow registration being increased would seem to favour the adoption of dry meters, though, even with these in American practice, it has been found necessary to have the diaphragms dipping in oil to prevent them becoming stiff.

It must be borne in mind when the cost of this system is being considered that although the trunk low-pressure main does not have to be altered, yet the low-pressure distributing mains beyond the point at which the high-pressure gas is delivered must be ample, as otherwise friction would throttle the flow. In this case, the trunk leaving the works was 24 inches in diameter, gradually reduced to 9 inches in diameter at E, and thence to A was 6 inches in diameter. As the village has grown since the high-pressure plant was installed, another distributing main, 8 inches in diameter, has been laid from E to A. So that the sectional area of the two is now greater than that of the 9-inch; and if the village still increases, as is quite probable, these distributing mains could again be safely doubled without increasing the 9-inch trunk main on the town side of the Peebles governor, as at times of small demand this size is ample.

In conclusion, it appears to the author that no definite opinion can safely be formed on the general question as to whether for extensions of distributing plant the high or low pressure system should be adopted. Local conditions are such important factors in this, as they are in most problems gas engineers have to solve, that each case must be investigated separately.

Discussion.

The PRESIDENT said he was sure the members had listened to the paper with a great amount of interest. Personally, he was very much interested in the question; and the more so as he thought he was (he was going to say) the "culprit" who laid the first main that Mr. Webb had to replace—at all events, he put it in under Mr. Meunier's supervision. He was acquainted with the whole of the district; and the difficulty of supplying the particular village marked "A" caused him a good many weary moments. This problem had occurred to him in the town with which he was at present connected. He had had to supply a district which was almost as far off as the village "A;" and it was unfortunately about 40 or 50 feet below the level of the gas-works. The consequence was that, being at the end of the district as well, it was a most difficult matter to supply. He got over the obstacle by putting in a very simple type of booster worked by a water-motor. He should have used electricity for the purpose, if he had had it, notwithstanding the fact that it would be considered by some to be disloyal. At the same time, he was not above using electricity if he could make a good servant of it. However, he employed a water-motor, and had a little floating bell which was set to certain pressures; and when the pressure dropped, it operated a double-beat balanced water-valve which started the water-motor. The fan was of the open type; and when the motor ceased to work, the water flowed freely through. It went on for a week or a fortnight without attention; the grease cups being filled up. It was only used during the winter months; and it gave an increased pressure of from 1 to 1½ inches. He endeavoured to make it increase the pressure still more for the purpose of lighting the lamps; and he succeeded more or less. But the extra pressure gave a good deal of trouble in the automatic lighters. However, the general question of high-pressure distribution was, in his opinion, one that would shortly be interesting to all of the members, if it was not so already.

Mr. J. T. LEWIS (Wellingborough) asked Mr. Webb what was the cost of the installation.

Mr. WEBB replied that he could not speak definitely, as some work had been done in connection with it since he left Stockport. The compressors cost between £500 and £600. The receivers cost about £10 to £15. Then there were the regulators, which cost £3 or £4 apiece; and there were the various stop-valves. They had about 5000 yards of Mannesmann tube, which cost, he believed, 11d. per foot delivered, and the 3-inch 8d. per foot. The total cost of the main was probably more than it would have been under ordinary conditions, because it had to be laid late in the winter. It was, in fact, November when they were laying it; and it was being done at the rate of some 350 yards per day, so as to get it finished before Christmas. So far as he could recollect, they borrowed £2500 for the whole job; but he did not know whether or not that had been exceeded. He was afraid he could not give any more information than that. They started with an ordinary scheme feeding into a low-pressure main, and spent a good deal of time experimenting. There was a Peebles governor, too. This was an afterthought. It was found it would be advantageous; and it was put in with the connections, a little house, and so on. There was all the expense of that. But he could not say that the cost of the installation would be any real guide to the members, because the work was carried out five years ago; and it was a difficult experience. The only help they could get from English works was the experience at Nuneaton. Therefore, this was largely pioneer work. In considering, too, the

working of the installation, it must be borne in mind that the compressors would do a great deal more work than they were doing at present. One compressor was now working each evening; but he did not think it was running more than 90 or 100 revolutions, and could do 150. Then, if they wished to put a high-pressure system north instead of south, they would only have to use the same receiver, lay the new mains, and fix the regulators. If they had to run the two compressors, a third would be needed in the engine-house to give a margin. This plant, however, had a much greater capacity than was required for the work it had to do at present.

Mr. J. T. Lewis (Wellingborough) said he was much obliged to Mr. Webb for giving them the approximate cost of this plant. His own interest in it arose from the fact that some years ago (he thought it was sixteen or seventeen years) he had to supply two villages. One was about 3 miles and the other 4¼ miles from the works, with another small village just about midway. Some eight years ago they found the consumption had increased so rapidly in one of the villages that the main previously put down was not large enough; and as the system of high-pressure supply was not at that time much known, he adopted the second plan which Mr. Webb rather condemned, of putting a gasholder at this particular village. He must say, judging from the figures Mr. Webb had given them, that he (Mr. Lewis) was perfectly satisfied that his plant at the time was quite the correct one, inasmuch as the holder being there had enabled him to supply the district with every success and with absolutely no trouble. The whole cost of erecting the holder and the workman's cottage, and putting in the main, was only about £1300. The consumption at that place was about 8 or 9 millions. Still the compressed gas system must have great advantages; and the information and figures Mr. Webb had furnished would be of value to him and others who might have in future to deal with this sort of work.

Mr. W. A. Sapey (Tamworth) asked whether Mr. Webb could give the members the total and maintenance costs of the main, with the annual consumption.

Mr. Fletcher W. Stevenson (Coventry) congratulated Mr. Webb on the interesting way in which he had put this matter before the meeting; and he was sure the information afforded would be of considerable use. He (Mr. Stevenson) had always been very interested in this matter of high-pressure distribution. But so far, he had not been converted to its use; and he did not think, from the information Mr. Webb had supplied, that he was now converted. In his opinion, a much better plan to have adopted would have been the second one, which was discarded as being too expensive. The high-pressure main they were told had been laid round a little longer course than was necessary, so as to avoid the chief streets. There was, therefore, no reason why a larger main should not have been laid in the same manner. Certainly there would have been a little extra cost; but that would not have mattered. The way in which he looked at this was that the 12-inch main laid from the works (shown in the plan by the heavy dotted line) would have supplied these villages quite sufficiently. They were told the compressors were put in for 24,000 cubic feet an hour; while they were only required for something like 20,000 cubic feet an hour. The 20,000 cubic feet an hour would not probably need more than a 12-inch main for 4 miles. He was only guessing these figures; and they must not be taken as definite. Roughly, the cost of the main would be £4800 —£1200 per mile for 12-inch; and the interest would be something like £250. Now £2500 was spent on this high-pressure plant; so that if they had spent another £120 or £125 a year on interest, there would have been no trouble from compressing plant and reducing-valves, and the thing would have gone on exactly as it had done. Well he still contended that even if a little extra cost was incurred, by taking the opportunity when cast-iron pipes were cheap to do a large extension like this one, there would be no necessity to resort to these systems of high-pressure distribution through small steel pipes. They had heard from Mr. Webb that steel pipes with socketted joints were not satisfactory. The metal was very thin; and caulking-up the pipe at one side loosened the jointing at the other side. He put this to a representative of the Mannesmann Tube Company, and said he (Mr. Stevenson) preferred flanged or screwed pipe. The reply was that in that case the pipe would have to be thicker—that there must be thickness enough for the screw—and then the pipes would cost more. Mr. Helps, of Nuneaton, had found the same difficulty—that these pipes leaked very badly with a setting-up of lead. The President had mentioned a case in which he had a low-lying district. The usual plan in many hilly districts, especially in some seaside places, where the works were situated away back, and gas had to be supplied to the foreshore, was to have a separate main to the foreshore with separate governor. Then there was no consumption on the higher ground, and the pressure was maintained on the lower ground and boosting was avoided. When he was at Sheffield, there was a case where one out-district was badly supplied; and the most direct way would have been to cut through the town 3 or 4 miles with a large main. But another direction was taken altogether. The main was taken round an easy road in which there was very little traffic; and this was coupled-up in the centre of the district, and the whole trouble was immediately overcome.

Mr. W. Langford (Longton) said he should like to know if Mr. Webb had any figures as to the relative leakage account before and after the introduction of the high-pressure main.

Mr. W. C. Jones (Brierley Hill) noticed that Mr. Webb spoke of the use of a diagrammatic meter. He (Mr. Jones) was also using two diagrammatic meters; and he could thoroughly recommend this system of finding the consumption per hour on any main. With regard to the jointing of Mannesmann tubes, he had found that cast-lead joints were not satisfactory. Mr. Webb said that probably lead-wool joints would give good results; and he (Mr. Jones) thought they would. As he told the members last October, he was then laying some 8-inch Mannesmann pipes with lead-wool joints; and the main he laid at the time was in ground that had been subject to severe disturbance. The surface of the ground had since then sunk over 12 feet; but he had only had to repair or set-up something like seven joints during the whole of the time—these pipes being jointed by lead wool. If they would stand this sort of treatment, they would stand any internal pressure. This was why he thought that probably lead wool might be a jointing material that would stand the higher pressures better than cast joints. Mr. Helps said last year that he found cast-lead joints were not satisfactory; and he (Mr. Jones) should have no hesitation in using lead-wool joints, and the thin steel mains of the Mannesmann Company. Local circumstances would always come into play in considering a system of the sort described by Mr. Webb. While it might be valuable to have a steel main laid in the manner shown for giving the necessary supply to a district, in other places local circumstances would interfere with its use.

Mr. Vincent Hughes (Smethwick) asked the horse power required to work the compressors. The reason he put the question was because he had had occasion to take this boosting business in hand recently; and in inquiring for compressors, fans, and exhausters, he was very much astonished to find the enormous difference of power stated by the various makers as being required for driving the plant which they proposed to supply. In the case of exhausters and compressors, the horse power was something like 50 to 60. He was speaking now of gas-engines. One firm who had proposed to supply the fan guaranteed to do the whole of the work with about 11 to 12 horse power, while another spoke of 50-horse power. Well, there was a big difference there. It was a good firm, so he had no reason to doubt their *bona fides*.

Mr. W. J. R. Baker (Great Malvern) said he should like a little more detail as to the working costs of compressing the gas per 1000 cubic feet delivered. At Malvern, they had a scheme for the supply of two districts; but the compression was by water-motors—the costs being simply enormous, and the compression most unsatisfactory. The compressors were rather under than over estimated. In one case the experiment had been tried of tapping the trunk mains, and discharging through a governor; and this was very satisfactory. He should be glad if Mr. Webb could give them some of his working costs.

Mr. W. W. Townsend (Hereford) inquired as to the experience in the working of these compressors. There were a number of compressors on the market; and one would like to know how, in practice, the different kinds worked out. Perhaps Mr. Webb could give some information on the point, including the cost of repairs and the number of breakdowns since the compressors were started.

Mr. Webb said that to reply to all the questions asked him would be rather a "tall order." Regarding Mr. Lewis's remarks, he had no doubt that, under certain circumstances, a gasholder would be the proper thing to put in. In the case described in the paper, the whole town was growing very much—west and north, as well as south-west and south-east; and in the last few years, the output of the works had increased from 600 to 800 millions. One consideration that weighed in installing the high-pressure system was really the taking of one case to gain experience for extensions, which it was seen would certainly be required for the other portions of the district in the course of the next few years. A holder would only feed into its own district; and Stockport was a town where the cotton-mills used a great deal of gas for gassing yarn during the day time, so that, if they had built a holder, there would only have been a limited time during which the holder could be filled ready for discharging in the evening. It did not therefore appear, considering the holder would only supply the one district, advisable to build one. Besides, it was a high-class residential district; and the residents certainly would not have liked a gasholder in the neighbourhood. Then Mr. Sapey asked as to the consumption of the village per annum. He (Mr. Webb) had mentioned that the maximum consumption of the larger village at the time was 9000 cubic feet per hour; but he was afraid he could not give the annual consumption. It was not exactly a question of annual consumption; but of the heavy peak. They had here a very high peak indeed. There were a large number of cotton-mills lighting up for three hours in the afternoon; and during that period—from (say) three to six o'clock—there was a tremendous consumption, and it was really for this period that boosting was necessary. Mr. Sapey asked the cost of the main. This came into the £2500 he gave as the rough total cost. He could not name the exact figure, because the main was laid under the conditions that he had described, in the short days of November, with a gang of about eighty or ninety men, laying about ¼ mile per day. It came out, he should think, to between £300 and £400 per mile. Mr. Fletcher Stevenson was in favour of a low-pressure system. Well, he (Mr. Webb) did not say he was in favour of a high-pressure one. (Laughter.) As he had said, the question was one that must be decided absolutely on its merits in every particular case. It was only a large works that could undertake the maintenance or the care of such

a system. Take a small works, where the engineer practically possessed the whole of the technical knowledge on the place. Such a plant would need technical knowledge above that of the ordinary gas-works governor attendant; skilled fitters were, in fact, required to look after the plant. If therefore in such cases the object could be attained with a low-pressure main, he should say leave the high-pressure alone. Mr. Langford asked about the leakage before and after the installation of the main. The main was installed about four years ago; and the leakage had gone down steadily, with the exception of the financial year ending last March. He had had a copy of Mr. Meunier's last report; and it showed a very slight increase indeed, and was attributed to the weather in the summer. He (Mr. Webb) did not think any increase could be attributed to the high-pressure main; and if suitable jointing was adopted, he could not see why there should be any increase at all in the leakage. Mr. Jones thought that lead wool would work satisfactorily for jointing. He (Mr. Webb) had no doubt it would; but he preferred either screwed or flange joints, or some of the special systems they had in the States. Mr. Hughes asked for the horse power of the compressors. Those installed were listed in the catalogue as from 35 to 47 horse power. They were designed for gas or air—25 lbs. to 40 lbs. delivery. They were powerful compressors, and worked very satisfactorily indeed. The only bad point about them was that they were not made in England—the makers being the Ingersoll Company, of New York. They were simple to work; and the cost of repairs he was told two or three weeks ago had been absolutely *nil*. There had been no failures whatever due to the compressors; and when he saw them they looked exactly like new. He thought that compression took considerable horse power. As Mr. Hughes remarked, he had estimates varying between 11 and 50 horse power; and no doubt the safest figure was the 50. Mr. Baker asked the cost of compression; but he (Mr. Webb) was never able to get exact figures as to costs at Stockport—that was, the running costs. They paid nothing extra for labour; but he did not know whether any increase had been given since. The compressors were situated in the engine-room; and the exhauster men looked after their lubrication and so forth. The boiler men kept up the boiler pressure. The only alteration made was that, instead of using coke-dust for firing with Wilton blowers, when the compressors were running the man was allowed to have a barrowful or two of good coke. There was the extra fuel used, but that was a very small matter to a gas-works, where the coke dust was utilized. There had been no repairs or breakdowns. One or two defects had occurred in the Crawford regulators. He saw that in Wales an installation of Reynolds governors had been used. Mr. Meunier was just now experimenting with a different diaphragm.

CULTIVATION OF SLOT-METER CONSUMPTION.

[A Paper read before the Midland Association of Gas Managers, Oct. 22.]

By Sidney O. Stephenson, of Tipton.

The success of the slot-meter is unquestioned; but while, generally speaking, slot-meter installations are a paying investment, there are many individual cases where they not only do not pay, but are a dead-loss. Some towns are affected worse than others in this respect; and in a few instances it has caused directors or committees to seriously consider the advisability of discontinuing the policy. As a fair amount of capital is expended on each installation, and the consumer is provided with a handy and economical light without any trouble or preliminary capital expenditure on his part, it is a matter worthy of consideration why certain installations do not pay and how they can be made to pay. It is the general practice to charge a higher rate for gas through the slot-meter; but, on the other hand, a considerable amount of capital is laid out in fitting up the consumer's house free of cost to him. It is obvious therefore that to be profitable he must burn sufficient gas not only to cover the cost of the gas, but also return a reasonable percentage on the capital expended on the installation. This means that he must be a regular *bonâ-fide* consumer, or he is a loss to the undertaking.

Most of us have had experience of the consumer whose contribution amounts to about 6d. in the quarter, and have known cases where oil is the usual illuminant—gas only being consumed on special occasions. Such are a distinct loss; and the question is how to deal with them. Now a consumer cannot be made to burn gas; but he may be induced to do so. Much has, no doubt, been done in this way, and more may possibly be done. It is necessary to get as great a consumption as possible, and therefore to provide means and inducements for the using of the gas as far as there is a probability of their being used. But discretion must be exercised, according to circumstances, to avoid laying out more capital than will be remunerative. Circumstances vary in different places, so that no general rule can be laid down.

In some towns, the installation includes several lighting fixtures and also a cooker. This increases the capital cost; but if the cooker is regularly used in addition to the lights, the outlay is justified. In the average colliery town, however, where coal is obtained very cheaply, I do not think it would be advisable to include a cooker, which would most probably serve as a cupboard for the blacking brushes—the top being the only part to be used. In those cases a griller or else a boiling ring, which are less expensive, are certainly preferable and worth providing. I have noticed, however, that in many towns where these are included in the installation, they are not made permanent fixtures—the consumer being provided with a length of flexible tubing to attach them to the nearest bracket. This, in my opinion, is a mistake. The tubing is frequently lost, and the consumer troubles no further, or possibly waits until the collector calls round. This portion of the gas undertaking's capital is thus lying idle and unremunerative. If the boiling burner or griller is made a permanent fixture, there is no tubing to take away, and it is always there ready to be used by turning on the tap—a convenience too handy to be resisted. At Tipton, we adopted the boiling burner about four years ago—no cooking appliance of any description being previously included in the installation—and have found that they are well used, and a good investment. We insist, however, on making them all permanent fixtures; and where no place can be found for them, an iron-sheeted wood bracket is provided. The boiling burners cost but a few pence each, and even with brackets included the outlay is not so serious an item as a cooker, or even a griller, and therefore does not necessitate so high an average consumption to make the installation a paying one.

There is no doubt that a great deal has been done to increase slot-meter consumption by encouraging the use of gas for heating purposes. Exhibitions have been held, canvassers have gone round, and lady demonstrators have paid house-to-house visits to give instruction on gas cooking to artisans' wives. This appeals to me as an excellent idea if the instruction will be appreciated; for it is the lamentable ignorance of cooking and management of cooking appliances among the working classes which tends against better and more consistent use of the cooking appliances which we provide, or would like to provide. Too often knowledge of cooking stops short at the frying pan; and for that a boiling-ring is amply sufficient. If these people can be educated to a better knowledge of cooking, then so much the better for us; for there is no better or more economical way of cooking, properly managed, than by gas.

But after all, the main consumption we have to look to from the slot-meter consumer is for lighting; and unless he is using gas regularly for the lighting of his home without depending on other illuminants, then the possibility of the installation being a remunerative one is doubtful. And it is the lighting, so far as the slot-meter consumer is concerned, to which I fear we pay least attention. Why we should press upon our ordinary consumers the most modern form of inverted incandescent lighting, and at the same time supply our prepayment consumers with the most antiquated, uneconomical, and out-of-date form of lighting I cannot understand. Yet this is what is being done in the majority of towns. The fitting usually considered good enough for this consumer being a cork-slide pendant fitted with a union-jet flat-flame burner. It is little wonder he is contented to go on using oil. If he is enterprising enough to buy an inverted burner for himself, he invariably goes to a local gas-fitter or ironmonger, or possibly a cheap-jack in the market place, and just as invariably buys some of the cheap and useless trash with which the country is flooded, and is afterwards more discontented than ever. Furthermore, the most unsuitable of all gas fixtures to which to attach an incandescent burner is a cork-slide pendant.

I make a practice of investigating some of the complaints personally, and have found many due to cheap and trashy burners, and quickly remedied when they are replaced with good ones. This is evidence that these people want a good light; and if they can have it, they will burn the gas. It caused me to reflect why we should not provide them with the most up-to-date, efficient, and economical light—viz., a neat fitting with a reliable inverted burner, instead of the old cork-slide pendant. On going into the matter, I found that such a fitting could be obtained at no greater cost than the cork-slide pendant; and, as a result, we have adopted them in our slot installations, and they are appreciated and used. We make an extra charge of 6d. where they are fitted, not because we need the 6d. but to ensure their being taken where they will be appreciated, and the mantles and globes renewed when broken. I hardly think, however, that the precaution is necessary; and doubtless we shall later on remove this charge. At present I have more orders for them at the 6d. than I can keep pace with. We supply renewal mantles and globes at the special rate of 3d. each, which leaves us a small margin of profit; but it brings them within reach of all, and gives little excuse for not maintaining the light. I am pleased with the venture so far as it has gone; and it will, I think, encourage a greater and more regular use of gas for lighting among our prepayment consumers.

What amount of consumption is necessary to make a slot installation remunerative? At Tipton, an installation which includes two pendants and a boiling burner (the latter being of the type which does not get stopped up if anything boils over), costs from £3 5s. to £3 10s. inclusive of service. The total cost of the gas, including all charges, is 2s. 1d. per 1000 cubic feet; and the prepayment consumer receives 25 feet for 1d. Presuming that he uses a pennyworth of gas per day, this gives £1 10s. 5d. for the year, with a consumption of 9125 cubic feet. The net cost of the latter will be 19s. There is therefore 11s. 5d. profit to pay interest on the capital outlay above, or over 16 per cent., which is a very fair return. Each must apply his own figures to his own case; but I think the above will represent a very fair average illustration. It is obvious that where the figures are anything like these, if the consumer burns a pennyworth of gas per day throughout

the year he must be a very profitable one to the gas undertaking. A customer who does not burn this quantity of gas can hardly be described as a regular consumer; and it would seem that something is wanting to educate him as to its advantages, or make it more attractive to him.

One branch of slot-meter business to which this paper perhaps hardly applies, but which is increasing, is the use of shilling in the slot meters among middle-class householders. They are becoming increasingly popular with this class because of the continual check which the consumer has over his consumption, added to the convenience of paying as the gas is taken rather than having a quarterly account. I am inclined to regard it as an advantage to both gas undertaking and consumer; and I think the use of these meters will become much more general. The consumer is able to check waste and avoid a bill; and the gas undertaking receives the money quicker and with little trouble or expense, avoids disputes and bad debts, and has not the trouble of sending out accounts. It is a question whether a consumer who has a shilling in the slot meter and provides his own fittings should not have his gas at a cheaper rate than the ordinary consumer, rather than otherwise.

In conclusion, I think that by a little educating of the prepayment consumer to the advantages of gas, providing him with efficient, attractive, and up-to-date fittings, and avoiding the use of flexible tube connections to grillers and boiling burners (making them permanent fixtures instead), the number of unremunerative consumers can be reduced and the business made more profitable. I would like to add that the educational part, so far as cooking is concerned, has mainly been undertaken by the gas-stove firms up to the present; but I hardly think it should be left to them. I am of opinion that it would pay gas undertakings to employ a lady demonstrator permanently to visit the consumers and assist and instruct them in the use of their cooking appliances, and see that they are using them properly. They could besides keep an eye on their lighting, and advise them thereon. We know from our books which consumers are not burning regularly; and these could be assiduously looked up and any difficulties explained to them. In cases where a number of small gas undertakings are grouped near to one another, they might find it of advantage to employ a demonstrator between them.

One very useful cooking appliance as an alternative to cooker, griller, or boiling ring, which I have not mentioned is the hot-plate—practically the top of the cooker. It combines the advantage of all three with the exception of the oven, and is not at all expensive. It takes up more room, however, than the griller or boiling ring—an important matter in some instances; and with a good lady demonstrator at work, it would very likely be found better worth while going the "whole hog" in most cases, and providing a cheap cooker. There is also on the market an adaptation of the Dutch oven for use with boiler rings, though I cannot speak with much experience upon it. Still, the opportunities for the slot-meter consumer to use gas are plentiful; and it is for us to induce him to use it.

Discussion.

The PRESIDENT said the members had listened to Mr. Stephenson's paper with a great deal of interest. His views on certain of the matters dealt with would probably be considered by some of the members as, in a measure, heterodox; but with a good many of the views he (the President) would be prepared to associate himself. There was the question of cookers for prepayment consumers. He had had experience of these. Whereas in some towns he had no doubt they would be an excellent investment, there were many others where they would be an equally bad one. At West Bromwich, the experiment was tried; and a good class of cooker was fitted to the extent perhaps of 200 to 250. But they found that it was by no means so successful as they had a right to expect it would be. Consequently, they had not done anything further. He also quite agreed with Mr. Stephenson as to educating the slot consumer to use the best means of gas lighting. It was a slow and tedious process no doubt; but he thought something of this kind would very soon bring about the desired result. Although he had not gone so far in this matter as Mr. Stephenson, he quite thought his procedure was on the right lines. There, again, one would have to pick his consumers. It would not do to put a mantle in everybody's house.

Mr. VINCENT HUGHES (Smethwick) said they had supplied incandescent burners to their slot customers for the last five years; and he could testify to the appreciation in which they were held, because he found that, when some of the consumers left their houses, they took the incandescent burners with them. (Laughter.)

Mr. W. W. TOWNSEND (Hereford) remarked that in Hereford it had been the practice to fix a cooker free. They had now more than 2000 free cookers fixed. But they were so small that they were of very little use; and he found, in the majority of instances, the inside of the cooker had not been used at all, except as a cupboard for blacking-brushes. The tops of the cookers had been liberally used. In his opinion, it would be a better plan to charge as low a price as possible for the gas, and put in nothing free unless it was a griller, and to hire cookers at a nominal rental. Even a slot consumer could pay 6d. or 1s. a quarter rental for gas-stoves. In his case, he could not take out these 2000 small cookers, and put in larger ones; so he had adopted the plan of giving to the slot consumers a 14-inch oven on payment of a merely nominal rental. He had increased the slot consumption per consumer by over 1500 cubic feet since he went to Hereford. This last summer they had been putting out these larger cookers (since they had got known) at the rate of two or three a day.

Mr. MEIKLEJOHN: What is your present average consumption?

Mr. TOWNSEND replied only 9000 cubic feet per annum. Hereford was an agricultural centre; and the slot consumers were not such a good class as they had in industrial towns.

Mr. W. G. S. CRANMER (Willenhall) said that cookers seemed to be the point of interest with the speakers so far. He did not agree with putting in a cooker with every slot installation. In his case, they avoided all question of extra payment by giving 1 cubic foot less gas for a penny where a cooker was fixed; and consequently they only put them in where they were asked to do so. At the same time, they had a good demand for them; and though their district was to a certain extent a colliery one, where there was cheap coal, and many of the gas consumers were employed in collieries, and so got free coal, at the same time they found these were the very people who were more inclined to have cookers than the others who did not get free coal. The collier, as a rule, was not at all particular how he spent his money. So long as he had got money, he did not think anything about saving it. If he thought there was any convenience in having a cooker, he did not trouble about his free coal. If, however, rent was charged for the cooker, they found it almost impossible to get it. Before they put in cookers, they rented some small grillers. The result was by no means satisfactory. They could never get the rent for them. Then they tried cookers; and they put in rather a better one than was their custom, for which they charged 2s. 6d.—somewhat on the same principle as Mr. Stephenson charged 6d. for the incandescent light.

Mr. STEPHENSON: Only one 6d.

Mr. CRANMER: Well it is only one 2s. 6d. that we charge. Continuing, he said with regard to incandescent lighting in slot-consumers' houses, there were plenty of them who appreciated incandescent lights, and could make the best use of them. Among the working-class population, however, incandescent burners were rather delicate things; and they were not treated as gently as it was necessary they should be if they were to be a success.

Mr. FLETCHER W. STEVENSON (Coventry) asked whether the whole object of the slot-meter system was not for the consumer to put a penny in the slot, and take out the value, without any charge beyond? His view was to give the slot consumer what one liked or determined upon—gas-fittings, or griller, or cooker, or all three, or none of them, but make the quantity of gas given for the penny to suit, and not ask for further payment. It was very difficult to collect from slot consumers in large towns a rent for cooker or for supplying burners or anything else. In Coventry, they made it a rule not to supply gas-fittings unless cash was paid down; and they made the price the very least they could do it at. Therefore, they never lost anything by it. They could do the same with the slot meter; and why should they not do it with other things as well? With regard to gas-cookers, his experience was not at all what one or two of the speakers had stated. He understood from Mr. Stephenson that it was the lighting they wanted. He (Mr. Stevenson) did not agree with that.

Mr. STEPHENSON: I said it was the main thing.

Mr. STEVENSON: Very well. I do not agree with you. The main thing (he proceeded to remark) was the cooking; the light was a much smaller matter. They had in Coventry some places where they made provision for no light at all—only gas-cookers; and they took as much as 50s. a year out of the boxes. This paid very well. The average consumption last year for the slot consumers of Coventry (there were about 10,000 of them) was rather over 15,000 cubic feet, which worked out to about 50s. each. They supplied only a small cooker for that—no light at all; and the people almost always provided their own light. What, however, he wanted to impress very strongly was that they should furnish whatever they intended to supply all within the penny; and nothing else should be charged.

Mr. W. B. SMITH (Walsall) also thought that slot installations would become somewhat complex if they began to introduce monetary matters beyond the penny in the slot. He had had brought before his Committee's notice a very important outlay. First, there had been a further reduction of price to the slot consumers; and, secondly, the provision of cookers. They had, as he explained to his Committee, some 40 consumers using slot meters who were paying rent; but, as he told them, he should never support supplying cookers indiscriminately to every slot consumer. The experience he had gained had been that of other speakers—that the use to which many of the cookers would be put would be merely as cupboards. But if the slot cooker was properly fixed in the ordinary way among consumers who would use them, and no special charge was made, he was sure it would be a very great advantage; but if they were indiscriminately fixed, there would be a serious loss. With regard to incandescent lighting, it was a very meritorious action on the part of any gas manager who supplied incandescent burners to these consumers. But his experience was that, when they were first introduced in the street-lamps, they were no sooner put up than they were taken away. (Laughter.) If people would do this in the streets, they would do it in the houses. So it had been with some of their grillers. They had been taken away, and they had never seen them again; and if a sample incandescent light was supplied, these consumers would want them to supply the mantles as well. The right direction for everyone was to increase consumption—not for lighting,

but for heating; and the slot consumer should be treated in the same way—on a free basis throughout.

Mr. W. C. Jones (Brierley Hill) inquired what was the extra cost per 1000 cubic feet at Tipton through the slot meter above the ordinary consumer.

Mr. Stephenson: 7d.

Mr. Jones said the question of installations with slot meters was one that they had not yet adopted at Brierley Hill; and therefore this experience would be useful to them, as the matter had been under consideration for a long time. They had slot meters, but no installation of fittings. The difficulty they had to contend with was that their gas was rather high in price, due to local circumstances; and they could not give the quantity of gas for a penny that Mr. Stephenson was doing. Personally, he had favoured the putting out of the gas-cooker. He agreed with those speakers who stated that they found cookers serviceable. He took the trouble some years ago to take out the individual consumption of gas at places where cookers were in use, and where they were not. He found the average consumption in the slot-meter houses without cookers was about 6000 cubic feet. With the cooker, it got up to 13,000 to 15,000 cubic feet—that was, in the same class of house. He was perfectly sure that installations would pay if properly fitted up with small cookers placed with discrimination.

Mr. W. Langford (Longton) emphasized the need for cookers on putting in free fittings. In his case, they carried in a ½-inch trunk supply to the kitchen to a proper position for the fixing of a stove, and then left it for the consumer's decision as to whether or not he would have a cooker. If he liked to have one—the cost not exceeding £2—the additional consumption paid for the extra cost of the cooker. The artizans and their wives were often engaged all day, but they cooked at least once a week; for it was necessary to increase the pressure at least 5-10ths from 11 to 1 o'clock. They wanted to encourage the use of gas very liberally during the daytime; and cookers were one means by which they could attain this object. They were fixing about 300 free installations per annum.

Mr. T. Watson (Rushden) said the policy of his Company had been all along to make a small charge for cookers, with the idea that only those who wished to use them would ask for them to be supplied. With his Company this had paid splendidly. They charged about 8 per cent. on the cost of the cooker as rental; and they had no trouble whatever in collecting the rent—at least nowadays. Some few years ago, when the free system was started, they had a little difficulty on reductions in price; and they therefore gave the slot consumers the benefit of a discount when the collector went round. Their consumers were now getting 18 per cent. discount; and this practically covered the rent of the cooker, so they were on the safe side in this respect. He did not agree with Mr. Stephenson that the main thing to look for in slot installations was the lighting. One cooker was worth several lighting installations. This, however, had been their experience at Rushden. They had now over 2000 slot meters in use. The greater number averaged 15,000 cubic feet; but the average of the 2000 was about 13,000, because they had 600 or 700 fitted for lighting only; and this brought down a bit the average over the whole. It was better to charge for the cooker, because it prevented requests coming in from people who would use them but little; and this meant unremunerative capital expenditure. His Board were extremely well satisfied with the lines on which they had gone so far.

Mr. J. T. Lewis (Wellingborough) also took exception to the statement that the lighting was the most important part in connection with slot installations. It was the common experience that the cooking should be so described. In his opinion, too, he thought everything should be included in the charge for gas when they had slot meters. He would give a practical illustration of this. He was connected with a Company of which his friend Mr. Ruggles was the Manager; but before Mr. Ruggles' time they adopted the slot-meter system, and charged a rental for the cookers. He (Mr. Lewis) was Chairman of the Company; and for years they had constant trouble with the arrears due from these slot consumers. They could not get the money; and it was a wretched business altogether. About one-and-a-half or two years ago, they gave up the system entirely, and offered consumers a chance to have a cooker if they wished it with the slot meter. The system had worked splendidly. In Wellingborough, they had followed the same system.

Mr. Stephenson, in reply to the discussion, said he was extremely gratified with it. Generally speaking, it proved that circumstances ruled cases. The President had found the adoption of cookers unsuccessful; but he believed in what had been done at Tipton with incandescent burners. Some speakers did not agree at all that lighting was the main thing; but he thought there was some confusion on the matter. He did not say they should go for lighting alone; but he said they should induce the use of gas for heating and cooking, while maintaining that lighting was the main feature. If they provided slot meters for cooking alone, they would not get sufficient consumption to justify them. Whereas some people would use the cookers, some would not; and if they had cooking alone, the system, he was confident, would not pay. Cooking was wanted in addition to the lighting; but lighting must be the mainstay. Mr. Hughes was agreeable to the use of incandescents among slot consumers; but he had had some experience of the stealing of the burners. He (Mr. Stephenson), however, thought that probably this was not very great. Burners were so cheap in these days that he did not think many consumers would walk off with them. But on the general question as to the provision of incandescent burners as compared with flat-flame ones, animal life liked light; and if the slot consumers were provided with something that would give them a good light, they would burn it for the pleasure of seeing it. The provision of the inverted light would be an advantage; and the consumers would be pleased to use it. Mr. Townsend bore out his statement that the inside of the slot cooker was not used to a great extent. This pointed to the fact that if a lady demonstrator was employed, they would get the inside of the cookers used more. The working classes were not well up in cooking. They did not understand much beyond frying; and it was the inside of the cooker that the gas supplier wanted to see used as well as the outside. Mr. Cranmer found he could not get the rental for the cookers when they charged one. It was a general experience that if anything was provided for which a rental had to be charged to the slot consumer, there was some difficulty in collecting it. The fundamental idea of the system was that the slot-meter consumer could not afford to pay a bill at the end of a quarter. This was true of the general run of them. If they were asked to pay 1s. 6d. or 2s. for the rental of a cooker, that was a big sum; and they could not find the money to pay it. It was far better to collect all charges in the price of gas. It was also said that incandescent burners were not suitable for everybody, and particularly for the working class. With this he quite agreed, and that was one thing that had induced him to propose to his Committee to charge 6d. for a burner. He felt that the consumers who would pay 6d. to get a little gas-fitting, would maintain the burner. Those who would not pay 6d. must continue with the flat-flame burner. If Mr. Stevenson was getting 50s. a year out of his slot consumers, he was doing uncommonly well; the majority of gas managers would like to do as well. Mr. Smith did not believe in supplying cookers indiscriminately with slot meters; and he (Mr. Stephenson) did not think any one of them did. But if they were going to supply cookers, they could not make flesh of one and fowl of another, especially in local authority concerns, unless some differentiation was made by charging a little extra, or educating consumers up to the use of them. Mr. Watson found his cookers paid him well. That was a matter of circumstances. At Rushden, a discount system had been adopted; and the discount went towards the rent. They allowed the slot consumers a discount at Tipton; but they had nothing extra to charge in the way of rent on the cooker or anything else. It made it much easier to get back anything that was owing; and it encouraged the use of gas. If there was no discount, it made collection much more difficult.

Projected Gas Exhibition in Chicago.—The American Gas Institute and the National Commercial Gas Association are to hold an exhibition of gas appliances on a large scale on the occasion of the meeting of the Association in Chicago in the second week in December; and the preliminaries have been settled by Mr. J. C. D. Clark, the Chairman of the Committee of Arrangements, and Mr. Frank W. Frueauff, the President of the Association. The building chosen for the exhibition is the First Regiment Armoury, which appears from the illustration to be very spacious; and it will be beautifully decorated. A good deal of publicity will be given to the exhibition, especially in the larger cities and towns of the States, with a view to carrying out the educational feature. The idea is to let the people know that the gas industry is a great and advancing business; that it is stable; that its value as an investment is not impaired by competition; and that its destiny is as important as that of any other modern enterprise.

Rating of Gas-Engines.—According to "Engineering Record," this subject is likely to be one of those which will shortly receive the attention of the American Society of Mechanical Engineers, or some other body equally competent to settle the matter in the same way that the Centennial Committee settled the rating of steam-boilers. The gas now used in internal combustion engines ranges in calorific value so widely that it is out of the question to be satisfied with a statement of engine efficiency on the basis of the volume of gas consumed, even if this is expressed as at a standard pressure. It is quite customary to speak of the efficiency of a gas producer and engine plant in terms of pounds of coal per horse-power-hour. This, however, is unsatisfactory, because the thermal value of the coal ranges very widely; and as experience is gained in the use of cheap grades of lignite, the range is becoming still greater. It is considered that a way out of the difficulty would be the adoption of the thermal value of a gas reduced to a standard gas pressure as the basis of comparison. But the determination of the thermal value of a gas, while not so difficult as that of the value of a sample of coal, is likely to be troublesome enough to prevent any really serious general adoption of the method. Makers of automobile engines were puzzled over this subject for some time; but rules have now been agreed to which are essentially empirical, but give pretty fair average results when using gasoline as a fuel. It is not unlikely that, as experience is gained with the use of large gas-engines, some such method of rating them will be adopted, though it will throw on the purchaser more technical responsibility than he assumes when he purchases an engine under a guarantee that it will have a certain horse power with a stated consumption of a given fuel.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

Opening of the New Session.

The first Meeting of the Association for this session took place on Friday evening, at the Cripplegate Institute, E.C., when there was a large attendance of members. Mr. W. J. Liberty, the President, occupied the chair; and there were with him on the platform—in addition to Mr. H. E. Jones, who delivered an interesting address—Mr. F. W. Goodenough, Mr. Walter Grafton, and Mr. Henry Austin.

The Late Sir George Livesey.

The President, at the commencement of the proceedings, said they met under a cloud of sorrow, for they mourned Sir George Livesey, whose name was the first on their list of patrons. He who was their friend, was dead. So recently had he been taken from them that the many beautiful tributes to his memory were still fresh in the minds of the members—rendering it unnecessary for him to dwell at length upon the works of this great captain of industry. Though he was always at the service of the whole of the kingdom, yet they in the southern part felt they had a distinct reason to call him theirs; for born and cradled in the Metropolitan area, the London Gas Companies and the Committee-rooms of the Houses of Parliament were the workshops where he graduated and came to a full fruition. As to Sir George's great work for the gas industry, last year—the centenary year of the industry—it was his (the President's) privilege to pen a short *résumé* of the chief events in the hundred years of gas lighting; and so deeply was he impressed with the large share of work done by Sir George during the last forty years of this period—colouring it with his inventive mind, his charming personality, and his great moral character—that he felt he could not conclude that *résumé* without placing on record his feelings, which he did as follows:—

> In compiling this history, I have in no wise gone out of my way to introduce the name of Sir George Livesey; but in my research the name so continually cropped up during the last forty or fifty years of the gas industry, that I was compelled to insert it as frequently as I did. The only compunction I have is in having done so little justice to one who, by his intelligence, foresight, tact, and determination, has done so much to raise the industry to its present proud position, and whose name will rank with that of Clegg, the great gas engineer of the first forty or fifty years, who, by his inventive faculty and indomitable courage, lifted the industry from the rut in which it had found itself in those early days.

These remarks, he believed, voiced the feelings of all present. Sir George took a most deep and sympathetic interest in the Association, and only a short time since he received the following letter from him:—

> Dear Mr. Liberty,—The proposed meeting and visit at the Old Kent Road Works on Saturday, Dec. 5 next, will be just the thing. I am sorry I cannot attend your opening meeting on Oct. 23, but it will be much less formal to have a friendly talk at the gas-works. I shall be very pleased to meet and make the acquaintance of your members, for whom I entertain a strong feeling, as the result of reading their excellent papers and of what I have otherwise heard of them.

He well remembered the dark eighties, when Sir George called upon his fellows to follow him in new paths; and if asked whether he was successful in the great task to which he then put his hand, he (the President) would point to the hundreds of representative men who attended uninvited the funeral at Nunhead, but more especially to the great and solemn procession of 7000 of his workmen who silently followed to his last resting-place the one who had enriched them in a far higher than financial sense—namely, by his personal contact with them. He would only add that the Council sent a floral tribute in the name of the members; and the Association were peculiarly honoured by its representative being invited to take his place among the mourners. He asked those present to testify their appreciation of their dead friend and their sympathy with Lady Livesey in her bereavement.

This the members at once did by unanimously rising in their places; and it was intimated that the Secretary would communicate the vote of sympathy to Lady Livesey.

An Address by Mr. H. E. Jones.

Mr. H. E. Jones then delivered an address to the members, in which he dealt with the labour question generally, and the great work performed, and noble example set, by Sir George Livesey. The address will be found on p. 261. At its conclusion,

Mr. Walter Grafton said that with the greatest possible pleasure he rose to propose a hearty vote of thanks to Mr. Jones for his address. Sir George Livesey took a very keen interest in the Association; and when it was first started, he wrote him (the speaker) a most appreciative and sympathetic letter. He said nothing, he thought, would elevate a worker more than a book or the studying of a paper that had been read by workers when deliberating together. He also touched upon the Polytechnic classes, which he thought were bound to be fruitful and good for the industry in every sense of the word. Mr. Jones had referred to labour; and he (the speaker) was quite certain, in seconding what had been said, that if they went about with their heart in their work, they would love their work; and if they loved their work, they would love the bread and cheese which followed it. Love for their work had a great deal to do with performing this work well. It was not sufficient to do the work to the best of their ability. They should try to improve what they were doing in some way or other, however small the detail might be; and in this way they would not only confer a benefit on their employers, but on themselves and on their fellow-creatures.

Mr. Henry Austin, in seconding the vote of thanks, said he wished to endorse, and if possible to emphasize, everything Mr. Jones had said with reference to Sir George Livesey. For ten years he had been on the Board of which Sir George was Chairman; and as long as he lived he would remember him as the best and kindest man he had ever come across. Mr. Jones's remarks on thrift reminded him of Sir George's manly teaching and practical example to his workmen. Sir George said: "There are two classes in the community—the one which spends, and the one which saves. Those who save will build mills and factories; and those who spend will have to work for them."

Mr. F. W. Goodenough, supporting the vote, said Mr. Jones's address exactly suited him. Mr. Jones had once more brought before them what he (the speaker) had on one occasion tried to impress upon them—the great necessity, if they were to lead a happy life, of taking an interest in their work, and following out the precept of "Whatsoever thy hand findeth to do, do it with thy might." They should never refuse to do the work they had to do just because they were anxious to do something a little better. They would never get the better work if they did not do as well as possible that which was at their hand. There was a tendency to regard every other job as being much nicer than one's own. But this was a great mistake. The important thing was to do the job one had as if it were the most interesting job in the world, and as if one's whole heart and soul were in it. Then jobs which were perhaps more interesting would very soon follow.

The President remarked that if they remembered only the definition of engineer—ingenuity in overcoming difficulties—Mr. Jones would not have given his address in vain.

The vote was accorded with acclamation.

Presentation to the Late President.

The President said that at the May meeting a vote of thanks was passed to Mr. W. Upton, the outgoing President, and it was resolved that it should be framed and presented to him. Mr. Goodenough had kindly offered to make the presentation.

Mr. Goodenough remarked that he had had a few, and the members had had many, opportunities of observing the business-like, tactful, energetic, and enthusiastic manner in which Mr. Upton had for two years fulfilled the duties of President of the Association. The result of the members' observation was the illuminated resolution which he held in his hand; and the result of his own observation was that it was his very great pleasure to be there that night to make the presentation to Mr. Upton. The resolution read:

> Annual General Meeting, May 8, 1908.
>
> This General Meeting of the London and Southern District Junior Gas Association desires to place on record its hearty appreciation of the services rendered by Mr. W. Upton to the Association during his presidency for the last two years, and hereby tenders to him its sincere thanks for the interest he has displayed, and the time and energy he has given, in all that pertains to the benefit of the members, and especially in his promotion of their educational welfare, and notes with gratification the increase of membership during his term of office. In thanking him on his vacating the chair, the Association trusts that he may be spared many years of useful service to the gas industry, with which he has been so long connected.

Mr. Upton, in returning thanks, expressed his great appreciation of the gift, but pointed out that he had had a very good Council to work with during his period of office, and that he had depended a great deal upon them. The members of the Council spared no time or trouble in promoting the welfare of the Association; and they all worked most harmoniously together. In conclusion, he urged all the members to take full advantage of the benefits which the Association offered, by joining in the discussions, and generally entering into the business that was brought before them.

An Address by the President.

The President then delivered an address, in the course of which, after thanking the members for electing him, and drawing attention to the work of the Junior Associations, he said:

We now in our own Association number about 150 members. Our programmes have been most full and interesting, and of such a character as should draw young men into membership with us. The Senior Society has shown cordial sympathy by their chiefs honouring us, by not only becoming our patrons, but by sparing their valuable time to come among us and give us some most delightful addresses, such as we have just listened to from Mr. Jones. They have also given permission to visit, and have conducted us in person over, their works, and shown us, as it were, the "inside of things," which must have helped us, and made us better servants to them in our working hours. With further regard to the Senior Society, during the last session two of our members were received into membership. This is as it should be; and we hope the coming session may be more prolific in this respect, and act somewhat as a feeder to the Institution.

The elementary and underlying principle of these Associations is

that they should be educational. The stress of the age demands that time should not be wasted on fruitless effort or misdirected energy; and though the paths from the school to the university and the workshop to the manager's office may be open to all and sundry, there are many who fail to tread them owing to the lack of a helping hand at the start. Nay, how many of us, in the early days, through lack of such guidance, found ourselves in "Blind Alleys," and had, not only to our great mortification, but to the irrecoverable loss of precious time, to retrace our footsteps and start afresh on our journey? It is to obviate this calamity that besets the path of the beginner that the six Junior Associations exist to-day. Are they useful? I think I am right in saying "Yes." The very fact of your being here at all proves to me that you have the desire to acquit yourselves well, and I know of no better way of doing so than by these periodical meetings to take over and compare notes on matters that have engaged your attention during the day, and also in the visiting of works where up-to-date plant can be seen in operation. Can the Associations be made more useful? I believe they can, in the coming together of the Associations of the country for interchange of thought and opinion, the discussion of papers of other Associations, and by the printing of joint transactions, &c. For instance, taking the Southern Junior Association, I find it is very strong on the distribution, but weak on the manufacturing, side; while the other Associations, owing to their geographical positions, are stronger on the manufacturing side. If we could discuss jointly these phases of the industry, together with the chemical and commercial sides, it would be an advantage to the Associations and a real help to the individual. Already a commencement has been made. Joint Council meetings have been held in Manchester and Birmingham, as well as a visit to Manchester, which culminated in the visit to London in August last, of the three English Associations as our guests, when opportunity was given them of inspecting some London manufactories and seeing the Gas Section of the Franco-British Exhibition. A joint meeting of the Associations was addressed in the Congress Hall there by Mr. H. E. Jones, after which a joint meeting of the Councils was held to further the scheme of co-ordination. At that meeting a permanent Secretary to the Joint Councils was appointed in the person of Mr. A. L. Holton, of Manchester; and the next joint meeting of the Councils was fixed to be held in Manchester in February. Only last week I noticed that the Yorkshire Association had altered their rules so that the President and Secretary for the time being of the Manchester and District Institution of Gas Engineers should be *ex officio* members of their Council. This is as it should be.

If I turn to our programme, I find that with regard to visits and papers it is full of interest. In these transitory times, when that which was the ideal in manufacture yesterday is scrapped on the morrow, it behoves us to be ever on the look out for the best, and to see how full of suggestion and invention the times are, how rich the mines awaiting exploration, so that the observing student can always fill his mind with new ideas. I remember last session visiting one works where, in connection with the carbonization, there were no less than five systems at work—viz., 27 beds of sevens, horizontals (or 182 retorts), with an output of 2,700,000 cubic feet per day, 13 settings of sevens, and 28 settings of eights, inclined retorts, with a daily output of 1,400,000 and 3,000,000 cubic feet, and eight of the new and interesting vertical retorts—two settings of four retorts in each—on the Woodall-Duckham system. In addition to the coal-gas plant, there were three sets of Humphreys and Glasgow carburetted water-gas plant, each having a capacity of 1,000,000 cubic feet per day—or about 7,000,000 cubic feet per diem when all the plant was working. An up-to-date instalment of De Brouwer system of charging and discharging was in operation in the horizontal retort-houses. With the privilege of seeing a works with such a wealth of ingenuity and various systems working side by side, dull indeed must be their minds if the members are not able to increase their store of knowledge and add something to the common good, either in the workshop or at the meetings. Then take public lighting. How full of suggestion to the student is this, as inventions follow hard after each other, both with regard to gas and electric lighting. For instance, in the City in which we find ourselves to-night—the "cockpit" of the fight, as it always has been, and will continue to be, from its position—has always raged the battle of the lights, whether of candles, oil, or the various forms of gas and electricity.

It was in this very Ward of Cripplegate—nay, in Golden Lane itself, where we are meeting—that in July, 1807, gas-lamps, under contract, were first put up; and since then the battle has continued, if not always with rival forms of light, with rival gas companies—at one time no less than three. Every person or syndicate who has a new type of light naturally turns to the first City to be allowed to experiment with the illuminant; and the authorities, ever anxious to obtain the best to light their important and crowded thoroughfares, willingly consent.

Notice the mixed lighting of this area. We find there are no less than seven or eight methods. There are the old arc lamps of about 700-candle power put up in 1892, burning side by side with the newer flame arcs of about 2000-candle power on columns, but one year old; while close by are similar "magazine" lamps of the "Oliver" type, and of about the same candle power. Suspended overhead by means of wires, and near by in an important thoroughfare is yet another type of electric lamp of lesser candle power, known as "enclosed arcs." All around the side-streets are brilliantly illuminated with the single incandescent Kern burners. Again, in another area close by is seen a good demonstration of high-power lighting on brackets, of single-burner lamps with a consumption of 10 feet per hour, giving an illuminating value of 30 candles per foot, and worked by duplicate compressing plant; while dotted about at the junction of the main roads are high-power gas-lamps of three and six burners, giving 900 and 1800 candles respectively. Yet no sooner were these compressing plants installed, than it was found possible to supply gas at high pressure direct from the mains, conveying it at a pressure of between 12 and 20 inches; the main being tapped and the necessary connections made under pressure—thus consigning the compressors to the scrap-heap. A large area of main road was lighted with double-burner lamps giving 600 candles at 20 feet consumption, without any mechanism.

Yet with all these forms of illumination, I repeat what I have said on many occasions—"There is no finality in public lighting." The field is wide open for the student and the inventor to roam at will. I well remember in the early spring of this year, in this room, the smile of incredulity I raised when I foreshadowed a further development of high-pressure gas lighting, far surpassing that already mentioned—viz., an inverted burner, which, with a consumption of but 10½ cubic feet of gas, under a pressure equal to 4 inches of mercury, or about 54 inches of water, would give a light of 663 candles, or between 60 and 70 candles per cubic foot. After the laugh had died away, I remarked, "When you see these lamps burning, do not forget that it was in this room that you first heard of them." Two months later, some 250 of the lamps were, and have been, burning nightly since at the Franco-British Exhibition; and so quickly do events move nowadays with regard to public lighting, that last week the City Authorities formally sanctioned the lighting of that best known of thoroughfares in the world, Fleet Street, with these high-pressure inverted lamps, to the displacement of existing lighting, which is but three years old; and all these forms of lighting, at the present rate of progress, might be termed more or less "experimental."

I mention these interesting facts to show how competition sharpens the inventive faculty, and the scope there is for all in research and invention. I conclude my remarks by again stating that there is no finality in the gas industry—whether in carbonization, in distribution, or in lighting. Look to it, then, that you are in the van.

Mr. GOODENOUGH proposed a hearty vote of thanks to the President for his interesting and instructive address. He congratulated him upon the well-deserved honour that had been conferred upon him in his being asked to take the chair; and he congratulated the members on having as their President a gentleman of such enthusiasm and such abilities as ensured for the members a useful and profitable time under his leadership.

Mr. AUSTIN seconded; and the vote was heartily accorded.

The PRESIDENT briefly returned thanks.

PROGRAMME FOR THE SESSION.

The programme of the session, so far as at present arranged, is as follows: Nov. 14, a visit to the Ilford Gas-Works. Nov. 27, short paper evening. Dec. 5, visit to the Old Kent Road Works. Dec. 11, paper by Mr. W. Briggs, on the "Production of Hot Water by Gas." Jan. 13, visit to be arranged. Jan. 29, paper by Mr. J. Campbell, on the "Construction and Erection of a 1,250,000 Cubic Feet Three-Lift Gasholder, and Concrete Tank for Same." Feb. 13, visit to the Kensal Green Gas-Works. Feb. 26, lecture by Dr. Samuel Rideal. March 10, visit to the Albert Glass Works, Lambeth. March 26, paper by Mr. C. J. Dickinson Gair, on "The Exact Methods of Technical Gas Analysis." April 17, visit to the Croydon Gas-Works. April 23, business meeting to be arranged. May 8, visit to the Bromley Gas-Works. May 21, annual general business meeting. It is proposed that a dinner and Bohemian concert shall take place at the Horse Shoe Hotel on Saturday, Feb. 20.

Laying Mains under Paved Roadways.—At the recent International Road Congress in Paris, a resolution was passed to the effect that authority should be sought to lay water and gas mains under paved roadways in exceptional conditions, and where there is no other practical solution.

First Award of the "Water Arbitration Prize."—It may be remembered that some time ago the Institution of Mechanical Engineers received from the Metropolitan Water Board and from Sir Edward Fry, the Chairman of the Court of Arbitration under the Metropolis Water Act, 1902, two sums of £250 each, which were placed at the disposal of the Council to utilize as they thought fit in the promotion of some engineering purpose connected with the Institution. The Council decided that the amount should be invested, and that the interest should be utilized in offering biennially a prize of the value of £30, to be known as the "Water Arbitration Prize," and to take any form which the Council might decide upon. The prize was to be offered for a paper on an engineering subject to be announced by the Council one year before the time of sending in the papers. For the first year of the award (1908) the subject selected was "The Filtration and Purification of Water for Public Supply." The date for receiving papers was the 3rd of July last; and at the meeting of the Institution on the 16th inst., it was announced that the prize had been awarded to Mr. John Don, of Maybole, one of the associate members.

SCOTTISH JUNIOR GAS ASSOCIATION.

WESTERN DISTRICT.

The first Meeting of the session was held in the Technical College, Glasgow, last Saturday evening, when there was a full attendance of members.

Mr. W. Wilson, of Falkirk, the retiring President, said the large gathering boded well for the success of the Association. It would be a great delight to the new President to know that, as an Association, they were not decreasing. Looking back over the past year, there had been such a number of instructive visits and important papers read that he thought the year's transactions would be hard to beat. It was usual for the retiring President to exhort the members to greater attention, for the wellbeing of their Society and of the industry they represented. He felt that such remarks would be out of place at the moment, when the life-story of Sir George Livesey was so prominently before them—a life-story which should make them all strive to emulate the deeds of so great a man. The President thanked the members for their courtesy to him during his term of office, and called upon his successor—Mr. A. H. Whitelaw—to occupy the chair.

Mr. John Fraser (Provan) asked the members to accord the ex-President a hearty vote of thanks for the manner in which he had conducted the business of the Association. This was cordially agreed to.

PRESIDENTIAL ADDRESS.

The new President then took the chair, amid applause, and delivered his address. Having briefly thanked the members for electing him, he proceeded as follows:

A gratifying feature during last session was the large attendance at three lectures delivered by Mr. Webber in the Glasgow Technical College; the subjects being heating, lighting, and cooking. He took as his standard an 18-candle power gas having a calorific value of 600 B.Th.U. per cubic foot, and explained clearly the evolution of the gas-burner—mentioning that for flat-flame burners a low pressure of 5-10ths was the most suitable, while for incandescent lighting a higher pressure of from 15-10ths to 20-10ths was necessary to force the gas through the contracted nipple of the bunsen burner. A pressure of 20-10ths gave a light of 20-candle power per cubic foot per hour. In the bunsen burner, the primary air mixes with the gas inside the tube, while the secondary air is taken from the atmosphere surrounding the flame. But the sum of the two supplies is the volume required for complete combustion, which in the case of Glasgow gas is about 6 volumes of air to 1 of gas. Speaking generally, the more primary air introduced, the less secondary air is required, giving a smaller flame and higher temperature. But this is only true within certain limits, for when forcing primary air into the tube, the cone and the flame become very small, and the temperature increases until a critical point is reached. Thereafter the temperature decreases; and finally the flame goes out. This occurs when the total of 6 volumes of air required for complete combustion has been introduced as primary, and no secondary air is required. Speaking of high-pressure lighting, Mr. Webber mentioned that, with a pressure of 52 inches, he got a light of 40-candle power per cubic foot per hour; and that although the gas was under high pressure, there was no pressure inside the mantle itself. The life of a mantle under high pressure must therefore be shorter, because of the higher velocity of the gas and air and the higher temperature of the flame.

The higher duty obtained with increase of pressure clearly points to the advisability of high-pressure distribution in large towns, more particularly for street lighting. It has been proved that the most economical method of distributing water, steam, and electricity is under high pressure; and the same is likely to hold good in the case of gas. There has been recently published an account of the lighting of Berlin by high-pressure gas—in all, 25 miles of streets. The lamps are provided with three inverted burners, each consuming 28 cubic feet of gas per hour, giving a light of about 3400 candles. The average duty obtained is therefore about 41 candles per foot, while the pressure at the extreme point of the high-pressure system is 53 inches. We must conclude that, no matter how well our streets are lighted just now under the low-pressure system, the lighting is capable of large improvement with the use of high-pressure gas. It is in realizing the fact that the gas industry has not yet reached perfection, but is capable of improvement and extension, that we become convinced of its stability, and of the great future before it.

The subject of suction gas is much before the public at present, and has been for some time. We must admit that the internal combustion engine in conjunction with producer gas, while a success, is still capable of much development. I purpose, therefore, making a few remarks which will have a bearing upon the subjects of thermal efficiency, producer gas, and water gas.

Thermal Efficiency.

Every heat engine requires a working agent; and the agents at our disposal are solids, liquids, and gases. Solids being good conductors, it is easy to transmit the heat to them; but, unfortunately, they are so slightly affected by the heat they receive or dispose of, that they are practically useless. Liquids are not much better than solids in the way they are affected, and being worse conductors, are of still less use. Gases being extremely sensitive to heat are therefore welcomed as agents; but it is difficult to transmit heat to them, because they are the worst conductors of the three. From the foregoing, it is not to be wondered at that steam should have been chosen and established a century ago as the agent to revolutionize the world, because when in the liquid form as water it takes up heat by convection, so that it can be used in its gaseous state.

Try to heat any other gas as steam is heated in a boiler, and the boiler-makers will be kept busy. Fortunately, times have changed, and there is now a satisfactory way of heating other gases than steam. It is sometimes said that the best "so and so" is none at all. In this case nothing is more true, for the best boiler is no boiler at all. Take the cheapest fuel that can be got—namely, gas derived from the partial combustion of coal in a producer—mix it with another gas which in combination will generate the most heat, which is air, the cheapest gas known, and the result is the most efficient form of heat engine of the present day, the producer-gas engine.

The Producer-Gas Engine.

The agent might be described as "fuel and air," roughly speaking, in equal parts. This would be as near the ideal as possible; for in this case the difficulty of heat transmission would be reduced to a minimum, because the only change required is the cooling of the gaseous fuel to a workable temperature. No fuel except producer gas requires so little as 100 per cent. of air for its combustion. Hence arises one point of its efficiency. Solid coal as fuel requires 200 per cent. of air to ensure complete combustion in the average boiler-furnace. Further, why is the producer-gas engine likely to be more efficient than a steam-engine, seeing that steam has the advantage of being heated while in its liquid state? The most efficient heat engine is the reversible one; but no heat engine is reversible where there is a sudden drop in the cycle of heat changes.

In the steam-engine (boiler included), a drop occurs from the high temperature of the furnace gases to that of the water in the boiler, which is comparatively low. This is the point where steam fails in efficiency, and the ground on which it can safely be said that its existence as a power agent is doomed to partial discontinuance after not many years. Mainly on this account, the efficiency of the steam-engine is limited to the maximum theoretical value given by Rankine, of about 30 per cent.; and the highest one can practically hope to obtain is 25 per cent., while the highest already reached in a few favourable cases is about 20 per cent. But to secure the last 5 per cent. will take tough fighting; and yet there is no reason why we should fight for it, for with the producer-gas engine an efficiency of 28 per cent. can be obtained after allowing 30 per cent. to go to the cooling water (which need not all be lost), and 42 per cent. to be carried away by the exhaust gases, the using up of which does not come under the category of impossibility.

If ignition occurred at absolutely constant volume, and all the heat were accounted for, and if expansion and compression were adiabatic, and all the clearance were in the ratio of 1 to r of the greatest volume, the efficiency would be given by the equation—

$$\text{Efficiency} = 1 - \frac{1}{(r)^{y-1}}$$

where y is the ratio of the specific heat at constant pressure to the specific heat at constant volume, and r is the ratio of compression. The greatest efficiency possible when using the Otto cycle compressing to 200 lbs. per square inch ($y = 1{\cdot}37$ and $r = 13$) is 53 per cent., as against the equivalent theoretical maximum value of 30 per cent. in the case of the steam-engine. It is not at all unlikely that we shall soon obtain an efficiency of 40 per cent. with engines working on producer gas, which means double the present efficiency of the best steam-engine plant; and in existing practice this ratio of efficiencies is already being attained, especially in plants up to 200-H.P.

The following table shows some working efficiencies to date:—

Engine.	Fuel Consumption. Pounds per B.H.P. Hour.	Thermal Efficiency. Per Cent.
Condensing steam-engine.	2 lbs. coal	8·25
Oil-engine	1 lb. petroleum	11·65
Gas-engine	20 cub. ft. town's gas	19·00
40-H.P. gas-engine (Dowson gas)	0·9 lb. coal	22·00
Marine triple expansion steam-engine	19 lbs. steam (160 lbs. pressure)	20·00
Diesel oil-engine	0·56 lb. kerosene	21·00
Locomotive	42 lbs. steam	9·00
Crossley's producer gas-engine (latest result)	0·65 lb. coal	30·00

The best result per Board of Trade electric unit for a steam-driven station is 5 lbs. of coal; whereas when gas plant is used, the consumption is 2·5 lbs. of coal. This shows a distinct advantage for gas-engines; and those who desire to generate electricity would be wise were they to drive their dynamos by gas-engines, instead of by steam-engines. Electricity is one of our strongest competitors for light and power; and while accepting this rivalry in a friendly spirit, we would show wisdom in endeavouring to get behind the electricians, and make them dependent upon us for the gas to work their engines. Even when using steam, the price of

electricity has fallen from 6d. to 3d. per B.T.U.; and a further reduction may be anticipated by the introduction of producer-gas engines, mainly due to the large saving in fuel consumption.

The question naturally arises, Would it be desirable that gas companies should put down special plant for the production of producer gas on an extensive scale, to be delivered to the public through special mains for heating and power? Such a huge enterprise could not be entered upon safely until an Act of Parliament were passed making it illegal to burn coal in an open grate. I believe that such a happy state of affairs exists in some parts of America; and if introduced into this country, it would put an end to the smoke and fog problem, while the public would have in gaseous fuel the cheapest and the best.

Producer Gas.

I shall now deal more closely with the subject of producer gas, and submit to you some notes which have proved useful to myself. The composition of air by volume being roughly 1 of oxygen to 4 volumes of nitrogen, we have $C + O_2 = CO_2$ (1 volume). This 1 volume of CO_2 carries with it 4 volumes of nitrogen; and each volume of CO_2 yields 2 volumes of CO—thus $CO_2 + C = 2\ CO$. Thus we get 2 volumes of CO + 4 volumes of N at the outlet of a perfect producer, or 1 volume of CO to 2 volumes of N, making 3 volumes. Hence the theoretical maximum values for producer gas working without steam are—

CO, 34 per cent.; and N, 66 per cent.

These values are never got in practice, owing to the imperfect reduction of CO_2 to CO; or it may be due to the combustion of part of the CO in the producer itself, giving a percentage of CO_2 in the gas. In practical working, the following rule is fairly approximate for both producer and chimney gases, in terms of CO and CO_2 present—

$$3\ CO + 5\ CO_2 = 100 \text{ per cent. volume.}$$

When we come to consider the producer using steam and air, the calculations are found to be more difficult. What is wanted is a method which will give the composition of producer gas under all conditions, and with varying quantities of steam. I have therefore prepared the following equations for finding the volume of producer gas, primary air, secondary air, and chimney gases in cubic feet, at atmospheric pressure, and at 0° C. temperature. The volumes found are per pound of carbon consumed; and in every case let x be the percentage weight of steam used compared with the weight of carbon.

Equations per Pound of Carbon.

Producer Gas.	Volume in Cubic Feet.	Percentage Volume.
CO	29·91	$34 + 0\cdot089\,x$
H	$0\cdot199\,x$	$0\cdot251\,x$
N	$56\cdot84 - 0\cdot3774\,x$	$66 - 0\cdot34\,x$
Total	$86\cdot75 - 0\cdot1784\,x$	100

Chimney Gases.	Volume in Cubic Feet.	Percentage Volume.
CO_2	29·91	$21 - 0\cdot031\,x$
H_2O	$0\cdot199\,x$	$0\cdot1304\,x$
N	113·67	$79 - 0\cdot0993\,x$
Total	$143\cdot58 + 0\cdot199\,x$	100

Air Supply.

Primary air	$71\cdot79 - 0\cdot4766\,x$.
Secondary air	$71\cdot79 + 0\cdot4766\,x$.
Total.	143·58 cubic feet.

From these equations, by giving x the following values, 0, 40, 50, and 60, I have prepared a table of volumes showing the changes which take place as the steam increases. With regard to the amount of steam that can be used in a continuous working producer, the question of temperature plays an important part; and it has been proved that about 80 per cent. of steam reduces the temperature in the producer to such an extent that it soon puts the fire out.

Though the figures in the next table are theoretical, they are interesting in so far as they show the possible maximum values obtainable; while they furnish us with a means of finding the efficiency of producers working in actual practice. The conclusions arrived at from studying the table are many; but I shall only mention one or two of the important features. The points worthy of notice are—

1.—When working without steam, the producer gas is a maximum, the chimney gases are a minimum, and the primary air is equal to the secondary air supply.

2.—The amount of steam passing through the producer, the hydrogen in the producer gas, and the steam in the chimney are all equal in volume.

3.—The more steam used, the less primary air and the more secondary air are admitted; but the sum of the two supplies remains constant.

4.—As the steam increases, the calorific value of the producer gas increases.

An important point, though not shown on the table, is that, when no steam is used, the temperature of the producer gas and of secondary combustion are a maximum. When the producer gas is used hot, working without steam gives higher thermal efficiency, because of the higher temperature due to the large amount of sensible heat in the gas combined with the heat of combustion. The reason why the use of steam lowers the temperature is because of the larger quantity of heat carried away by the products of combustion due to the high specific heat of water vapour. But this difference in temperature becomes less the lower the temperature of the flue gases; and when using the producer gas cold so as to eliminate the advantage due to sensible heat, the thermal efficiency is actually in favour of the use of steam. Hence for power production where the gases are cooled to allow more gas in the cylinder of the engine, the more steam used the better, because of the higher yield of hydrogen, and the consequent increase of calorific value. This is neglecting consideration of the fact that a gas of one active constituent (CO) can be compressed to a higher initial pressure than one containing high percentages of hydrogen, without fear of premature ignition; and higher compression by the formula quoted, means higher efficiency.

Table of Volumes in Cubic Feet per Pound of Carbon.

Producer Gas.	No Steam.		Steam 40 per Cent.		Steam 50 per Cent.		Steam 60 per Cent.	
	Cub. Ft.	Per Ct	Cub. Ft.	Per Cent.	Cub. Ft.	Per Cent.	Cub. Ft.	Per Ct.
CO	29·91	34	29·91	37·56	29·91	38·29	29·91	39·34
H	..	..	7·96	10·04	9·95	12·89	11·94	15·06
N	56·84	66	41·74	52·40	37·97	48·82	34·20	45 60
Total	86·75	100	79·61	100·00	77·83	100·00	76·05	100 00
Calorific Value	112 B.Th.U.		151 B.Th.U.		161 B.Th.U.		171 B.Th.U.	
CO_2	29·91	21	29·91	19·76	29·91	19·45	29·91	19·14
H_2O	..	..	7·96	5·22	9·95	6·52	11·94	7·82
N	113·67	79	113·67	75·02	113·67	74·03	113·67	73·04
Chimn'y Gases	143·58	100	151·54	100·00	153·53	100·00	155·52	100·00
Primary air	71·79		52·73		47·96		43·19	
Secondary air	71·79		90·85		95·62		100·39	
Total	143·58		143·58		143·58		143·58	

Suction-Gas Plant.

The suction-gas plant is widely known now; and in view of the fact that a lecture has been promised upon this subject towards the end of the session, I shall only make a brief statement. The plant consists of a generator lined with fire-brick, a vaporizer for converting water into steam, and an opening to admit through the fire a limited quantity of air charged with water vapour. The gas produced is just ordinary producer gas. It passes from the generator through the scrubber, where it is cooled (all dust being washed out), and then to the engine as required. In ordinary producers, the draught is caused by the chimney; but in this case it is effected by the suction stroke of the piston in the cylinder (whence the name "suction gas"), and the gas is only generated when the engine is at work. The fuel used in the generator must be free from tarry matter; otherwise the cylinder, valves, and pipes get choked with a deposit of volatile matter, and require constant attention. Anthracite coal composed of about 92 per cent. of carbon and 8 per cent. of ash is therefore usually employed.

The calorific value of suction gas varies from 110 to 150 B.Th.U. per cubic foot, which is only about one-quarter that of town gas. Hence to produce the same power in a gas-engine, four times the quantity of suction gas is required; and as it is not possible to get this large volume of gas into the cylinder at each charge, it is impossible to get the maximum power with suction gas—the difference being about 25 per cent. in favour of town gas. In other words, a gas-engine capable of developing 60-B.H.P. as a maximum on town gas, will only develop 45-B.H.P. as a maximum with suction gas. However, when fuel consumption and cost of running are considered, practical results show an advantage in favour of the suction-gas engine.

A 60-B.H.P. gas-engine working on town gas at 1s. 6d. per 1000 cubic feet, consuming about 18 cubic feet per B.H.P. hour, would cost about 1s. 6d. per hour for gas only. A 60-B.H.P. suction-gas engine will consume 1 lb. of anthracite coal per B.H.P. hour; and if the price of anthracite be taken at 25s. per ton, the cost per hour will be 8d. for fuel only. The plant requires 2½ gallons of water per B.H.P. hour; a small quantity being converted into gas, and the remainder being utilized in the scrubber for washing the gas. Hence 150 gallons of water are required per hour, which, at 6d. per 1000 gallons, would cost 1d. This brings the total to 9d. per hour—a saving of 50 per cent. in favour of the suction-gas plant. Now a suction-gas plant requires more attention than a gas-engine working on town gas; so allowing 2d. per hour for attendance, we have 1s. 6d. against 11d. per hour, which reduces the saving to 39 per cent. in favour of suction gas.

Account also must be taken of interest on invested capital and depreciation, which will be greater in the case of the suction plant, because of the extra plant required. Allowing 5 per cent. in each

case, the saving will be reduced to about 30 per cent. in favour of suction gas. Of course, with the fuel consumption cut down to 0·7 lb. per B.H.P. hour, and the price of coal varying from 15s. to 20s. per ton, this saving will be greatly increased. And as most makers of gas-engines are advertising and booming the suction-gas plant at the expense of town gas, it is quite natural that we should take more than a passing interest in the subject, and ask ourselves, How is this difference to be met, so that town gas can once more hold the supremacy for power, as it does for heating and lighting?

The remedy seems to lie in cheapening the cost of production, not so much by the cutting down of wages or by the introduction of labour-saving machinery, as by the adoption of methods which will force up the yield of gas per ton of coal at the expense of candle power. The question is sometimes asked, Which method of charging gives best results—light charges at short intervals, or heavy ones at long intervals? I think the experience gained from the use of vertical retorts and coke-ovens is the best answer to this question; for in both cases we have the carbonization of coal in large bulk, and the results obtained show that, while the quality of the gas remains the same, the yield per ton is greater and the coke better, the longer the period.

I lately had the pleasure of visiting the Norwich Gas-Works, where a setting of ten retorts had been replaced by one of six through retorts, 21 feet long, rectangular in section, 3 feet by 1 foot. These retorts are miniature coke-ovens, having a capacity of 22 cwt.; the period of carbonization being twelve hours. This setting was an experiment involving the introduction of a special discharging machine; but it is one which has justified itself, for the yield per ton has increased, and the quality of the coke is superior to that coming from ordinary retorts, realizing about 22s. per ton.

Candle Power.

The question of candle power is one which is ever recurring. But it is gratifying to note that gas companies and corporations are getting authority to lower their standard; and if the tendency is still down it is certainly a good one. Professor Lewes made a statement lately to the effect that the best standard of illuminating power is no candles at all. The inference from this is that the best standard to adopt is a particular calorific value; and so long as a gas contains the heat units to satisfy this standard, the original candle power is a matter of indifference. In coal gas, we have a gas of a comparatively high illuminating value; but the first thing we do is to destroy its luminosity in the bunsen burner, to secure complete combustion and a flame temperature sufficiently intense to raise the mantle to a high state of incandescence. It is quite clear from this that it is the candle power of the light emitted from the mantle with which consumers are concerned. It is heat units they want; the bunsen burner and mantle will do the rest. If a 14-candle gas of 560 B.Th.U. per cubic foot is sufficient for efficient heating and lighting, it is surely waste of energy to employ high-grade gas, such as one of 20 candles, of a calorific value of 700 B.Th.U. per cubic foot.

Water Gas.

The reduction of candle power will no doubt become general; and I am inclined to think that in the near future we shall have an extensive use of water gas worked as an auxiliary plant—the gas passing through a separate meter and mixing with the coal gas in the holders.

The first process in the making of water gas is the heating up, sometimes called the "blow," during which air is blown up through the generator until the coke glows intensely and has a high temperature. The producer gas thus formed is all consumed in the regenerator to heat the checker-brickwork; the necessary secondary air being introduced. The theoretical maximum of producer gas made per pound of carbon consumed during this process is 86 cubic feet. The second process, called the "run," is the water-gas making period, during which the air is cut off entirely, and steam alone is blown down through the incandescent fuel. The blue water gas formed will consist of CO and H in about equal volumes, roughly 30 cubic feet of each, making 60 cubic feet of water gas per pound of carbon consumed during the run. These figures are a theoretical maximum which will never be obtained in practice, because of the invariable presence of CO_2 in the gas, and also owing to the ash in the coke, which has been neglected. The process is intermittent; and for a continuous supply of water gas two generators are necessary—one to be heated up while the other is making gas. During the "run," the generator gets cooled down with the steam, and if carried too far some of the steam will pass off undecomposed, showing that the temperature is too low for the production of gas. The run should therefore be stopped, and the generator once more prepared by the "blow" for its true function of gas making. For good results, the temperature of the generator and the velocity of the steam should be attended to. Too high a velocity means that the water gas will be diluted with undecomposed steam; while too low a velocity results in a decreased yield of water gas per hour, and an increased loss of heat by radiation from the generator. The efficiency during gas making will, as a rule, increase with increase of temperature; but a systematic analysis of the chimney gases during the blow should reveal the percentage of CO_2, and therefore the particular temperature when maximum efficiency will be obtained.

Blue water gas, due to the absence of nitrogen, has about twice the calorific value of producer gas. Its theoretical value will be about 300 B.Th.U. per cubic foot; while in actual practice it is quite possible to obtain up to 280 B.Th.U. using coke. A richer gas can be manufactured by using bituminous coal; the volatile and tarry matter of the fuel being decomposed by the intense heat. The gas is thus enriched by the hydrocarbons produced, and its actual calorific value increased to 300 B.Th.U. per cubic foot. However, when water gas is an auxiliary process in a gas-works, there is no advantage in making directly from bituminous coal. It is more economical to carbonize the coal as usual, and use the coke for water-gas manufacture.

When carburetted water gas is being manufactured, the blue water gas goes direct to the carburetting chamber, where it meets the oil spray; and the mixture passes to the fixing chamber or "superheater," where the higher temperature fixes the oil and the water gas becomes carburetted, after which it goes to the scrubbers, condensers, and purifiers, and then to the gasholder. The whole process is an ideal example of the regenerative principle; and it is interesting to know that Mr. A. G. Glasgow (of Messrs. Humphreys and Glasgow), after elaborate research and calculation, has proved that—

1.—The fuel efficiency of the apparatus considered from a heat point of view is 61·4 per cent.
2.—The commercial efficiency of the plant (energy of fuel, *plus* heat of combustion of oil used) is 80·76 per cent.
3.—The oil efficiency (useful energy in oil gas, *plus* energy in tar recovered) is 91·8 per cent.

These figures speak for themselves, proving conclusively the practical efficiency of a carburetted water-gas plant.

Fuel economy is always an important matter; and to ensure this the generator-fire should be kept uniformly hot, varying as little as possible from the best temperature for gas production. This will keep the percentage of CO_2 low; and to this end it is desirable to have the runs and blows short and frequent. The relative lengths of the run and blow can only be determined by practice, as different fuels require different times; and for this reason the yield of gas per ton of coke must be found from observation. However, with modern up-to-date carburetted water-gas plant working continuously, a ton of coke containing 85 per cent. of carbon should yield about 75,000 cubic feet of carburetted water gas.

Assuming for the moment that every pound of carbon consumed in the generator as the result of a blow and a run yields 30 cubic feet of gas, then, when using coke containing 15 per cent. of ash, we get a yield of 25 cubic feet per pound of coke. Every ton of coke consumed would therefore yield about 56,000 cubic feet of blue water gas; and when this has been carburetted, the volume would be augmented to an extent depending upon the amount of oil used. Even this seems a high yield of gas, when we remember that it is only the gas from the second process that counts—all the producer gas from the blow being consumed in the regenerators. Practical experience of the plant goes to show that, the higher the quality of carburetted water gas within certain limits, the cheaper is its cost per candle. For instance, 2½ gallons of oil costing 3d. per gallon will give an 18-candle power gas at 1s. per 1000 cubic feet; whereas 3½ gallons will raise the quality to 25 candles and add 3d. to the cost. But the volume of the gas will be increased 10 per cent., due to the extra gallon of oil.

Coming now to the manufacturing cost of carburetted water gas, I quote an estimate for the cost per 1000 cubic feet of an 18-candle power gas; the estimate being based on a daily production of a million cubic feet in a single section of plant.

Manufacturing Cost per 1000 *Cubic Feet of* 18*-Candle Power Carburetted Water Gas.*

	Pence per 1000 Cubic Feet.
Generator coke, 40 lbs., at 7s. 6d. per ton	1·60
Boiler fuel, 15 lbs. breeze, at 2s. per ton	0·16
Oil, 2½ gallons at 3d. per gallon	7·50
Purification, lime and labour	0·75
Labour, excluding purification—	
Gas maker — 5s. 6d. per eight hours	
Helper — 4s. 6d.	
Boiler and machinery — 5s. 6d.	
Clinkering — 4s. 6d.	
Total wages per shift of eight hours, making ½ million cubic feet of gas = 20s.	0 72
Water, at 4d. per 1000 gallons	0·15
Repairs and maintenance	0·50
Management	0·20
Total	11·58
Less residual tar, ⅛ gallon, at 1¼d.	0·42
Total cost per 1000 cubic feet	11·16

For a greater production of gas, the cost of labour per 1000 feet would naturally be reduced. If the price of coke be raised to 9s. per ton, the price per 1000 cubic feet becomes 11·5d. It is quite evident that, even at 1s. per 1000 as the manufacturing cost of 18-candle carburetted water gas, it pays to make it; for the yield per ton of coke consumed will be not less than 56,000 cubic feet, and probably more; while the selling price of the gas seems to indicate that it is more profitable to convert the coke into carburetted water gas than to put it on the market at 10s. per ton. In producing a 24-candle gas, the coke consumption and other charges remain the same; but another gallon of oil is required, raising the cost to 14·5d. per 1000 feet.

The question naturally arises, Is carburetted water gas cheaper to manufacture than coal gas? To my knowledge, no such claim has ever been made. So many items enter into the cost of production that one cannot even say that the introduction of carburetted water gas will always result in a decrease in price. Its usefulness and economic advantages are, however, manifested by the large extension of carburetted water-gas plant in all parts of the world. Mr. James Stelfox, of Belfast, in the paper he read before the Gas Institute a few years ago, gave his own practical experience of the plant, and mentioned several advantages to be derived by enriching with carburetted water gas. I cannot do better than quote the advantages claimed for the plant—

1.—Saving in first cost about 50 per cent.
2.—Saving in ground space about 60 per cent.
3.—Saving in wear and tear about 60 per cent.
4.—Readiness for action. In three hours the plant can be brought from a cold state into full efficiency.
5.—Illuminating and calorific power can be changed instantly by varying the oil supply.
6.—Increased price of coke by reducing the output.
7.—Coal consumption reduced, and probable reduction in price. The coke from each ton of coal carbonized will yield 26,000 cubic feet of carburetted water gas, increasing the make per ton of coal carbonized from 10,000 to 36,000 cubic feet.
8.—The yield of coal gas per ton of coal can be forced up at the expense of illuminating power, reducing the cost of coal gas per 1000 cubic feet.
9.—Security against fogs. A prolonged demand can be supplied at a profit without reducing the pressure unnecessarily, and without overtaxing the resources of the retort-house.
10.—Prevention of naphthalene deposits. In large quantities it acts as a solvent. Permanence in distribution due to absence of condensable vapours, such as benzene and naphthalene.
11.—Improved combustion due to high percentage of carbonic oxide.
12.—Small proportion of sulphur in the crude gas—about 80 per cent. less than is usually present in crude coal gas. Oxide purification eliminates the sulphur almost completely.

These features are of great practical value; and if they cannot prove that carburetted water gas is cheaper to manufacture than coal gas, they certainly show that the reflex action of the former upon the latter is such that the manufacturing cost of coal gas can be reduced by putting all the benefits derived from the use of an auxiliary water-gas plant to the credit of coal gas in the accounts.

Analysis of Carburetted Water Gas.

I have prepared a table of analyses showing the percentage volume, candle power, and calorific value of several samples of carburetted water gas. It is interesting to note that different carburetted water gases of equal illuminating powers will vary greatly as regards their constituents, as these depend upon the method and conditions of manufacture and the materials used, rather than upon the illuminating power of the gas. This is also true of coal gas; and it goes to show that calorific value is not dependent upon candle power so much as on the chemical composition of the gas. The flame temperature of the gases in the table (including the coal gas) is given at about 2880° C.; the variation for the different candle powers being less than 1 per cent. For equal candle powers, the heating effect of carburetted water gas is about 5 per cent. less than coal gas. The air required for the perfect combustion of 1 cubic foot of gas varies from 5·5 to 6·5 cubic feet; while the products of combustion vary from 6·2 to 7·6 cubic feet per cubic foot of gas.

Table of Gas Analyses.

[Percentage Volume.]

—	Blue Water Gas.	Carburetted Water Gas.						Coal Gas.
Carbonic acid (CO_2)	3·5	2·5	0·2	..	..	2·20	3·8	3·01
Carbonic oxide (CO)	43·4	31·9	33·2	30 8	33·0	24·20	28·0	8·88
Hydrogen (H)	51·8	35·1	29·3	35·0	34·0	37·95	35·6	46·20
Methane (CH_4)	..	12·1	20·5	16·5	15·0	17·83	17·0	34·02
Hydrocarbons (C_mH_n)*	..	11·1	11·3	11·5	12·5	12·80	14·6	5·09
Oxygen (O)	..	0·5	0·3	0·4	0·5	..	..	0·65
Nitrogen (N)	1·3	6·8	5·2	5·8	5·0	5·02	1·0	2·15
Total	100·0	100·0	100·0	100·0	100·0	100·00	100·0	100·00
Approximate candle power	..	16	21	22	26	28	31	14
Calorific value B.Th.U. per cubic foot	308	600	674	650	662	704	720	642
Flame temperature	..	..	2880° C.					

* C_mH_n:—Ethylene, C_2H_4; propylene, C_3H_6; benzene, C_6H_6.

Regarding the proportion of carburetted water gas to be mixed with coal gas, it is quite evident that the higher the candle power the smaller the quantity required. To put it in the form of an equation, let

I represent the illuminating power of carburetted water gas,
C the illuminating power of the coal gas,
M the illuminating power of the mixture, and
Y the percentage of carburetted water gas in the mixture,

$$\text{Then } Y = \frac{100\ (M - C)}{I - C}$$

For example, to enrich 14-candle coal gas to 16 candles requires the following proportions of carburetted water gas: 50 per cent. of 18-candle gas, 20 per cent. of 24-candle gas, 12·5 per cent. of 30-candle gas, 8·33 per cent. of 36-candle gas.

Regarding the use of blue water gas, I believe it has had a fair trial, and has failed to prove itself a useful adjunct to coal-gas manufacture under present conditions of town supply. Its use must be confined to a limited percentage, and the saving, which is on the manufacturing cost only, does not equal the loss to the consumer due to depreciation in quality, whether or not the gas is benzolized. For equal candle powers, the price per 1000 cubic feet is about the same; but carburetted water gas gives an increase of over 30 per cent. in heating value as compared with benzolized blue water gas. It is not surprising, therefore, that on the Continent, where benzol is cheap, petroleum for carburetted water gas expensive, and illuminating power low (12 to 13 candles), gas companies have practically ceased to instal blue water-gas plant, and are putting in carburetted water-gas apparatus. In short, if any gas is to be mixed with coal gas, so long as lighting and heating are the main considerations, the diluent must be a gas of high calorific value. Even the admission of steam to vertical retorts is a failure according to one authority, whose interesting experiments show that the simultaneous carrying on of carbonization and water-gas production is not economical. His conclusion was that it did not pay to convert a retort into a water-gas generator; and that water gas made in vertical retorts was 64 per cent. dearer than when made in special generators.

Discussion.

Mr. A. Wilson (Glasgow) thanked the President for his very able and extensive address, which he was afraid it would be somewhat difficult to criticize. The President had dealt with such a variety of subjects, and given them such a mass of figures, that unless they had the address in their hands they could scarcely go into details. He was going to deal with only one or two points. The President looked forward to the happy day when it would be illegal to use coal in domestic, or, he supposed, any other fires. He was afraid that, unless some of them were to be very long livers, they were not likely to see that day; but it was a happy ideal to look forward to. If they supplied the gas which would be necessary for all heating purposes, it would be much better for them; and the people who lived in towns would have much better health, and be happier, if the smoke pall were cleared away. This, however, would not be attained by making new laws, but by showing people that there was a better and a cheaper way of doing things than by using coal. The President also looked forward to the happy time when there would be no candle power. He was afraid candle power would always bother gas men more or less. They had been bothered with it for a long time; but there was a benefit in having a certain candle power, for a variety of purposes, and it would be very difficult to convince the public that no candle power gas would be better. At the same time, the public were beginning to recognize that there was no necessity for a high candle power. In Glasgow high candle power used to be in vogue, and was considered a necessity; and the people were never satisfied with it. Their candle power had now come down to a more reasonable test—more reasonable in this way, that there was no difficulty in their giving it; and they scarcely ever heard a word of complaint about the quality of the gas. This proved that lower candle power was suiting the people much better. The manufacture of water gas was an interesting point. In Glasgow they did not find it of much benefit, because the cost of coal was so low that it did not pay them to make it. Even the manufacturers of the plant frankly acknowledged this, after going carefully into figures. The manufacture of water gas was certainly beneficial under some circumstances. Belfast had been instanced. There was no question that the manufacture of water gas in Belfast was a stroke of genius, he might say, on the part of Mr. Stelfox. But his circumstances were so unique that Belfast could scarcely be taken as a criterion as to the benefits of the water-gas process. The manufacture of water gas was continued in other places because it was found there was a benefit from it in other ways than cost. It was true that it was useful in time of fog; but if they had sufficient storage, they could very well do without it—at least he had not come to the point of recommending the adoption of water gas in Glasgow. Another point raised was that of heavy or light charges. The President came to the conclusion that, because vertical retorts were fully charged up, and took a long time to burn off, better results were secured from them. If the President went into the matter carefully, he would not obtain full corroboration for his figures. All matters had to be taken into consideration, and the larger yields of gas could well be secured with high heats and short charges. At the same time, there were points in vertical retorts which would make the process certain to take a large part in the production of coal gas in the future. The vertical retorts he saw in Berlin and Cologne, and the Woodall-Duckham, and those other arrangements the President inspected

at Norwich (which he himself had not viewed, though he had seen something similar), were all working in the direction of lowering the costs, and giving them more value from the coal, which was what they all wanted. The labour charges for verticals were low; and in the German system the process was very simple. But he was afraid the system of filling the retorts full and burning off completely would hardly suit their purpose, because the illuminating power of the gas was so low. They were more likely to find success in some continuous process—something like the Woodall-Duckham. He was glad to hear the other day that everything pointed to success in this style of drawing off the coke from the bottom. The authors of the system deserved success, for they had worked long at the problem.

Mr. S. B. Langlands (Glasgow) said the question of lighting came home to him; but the question of high-pressure lighting in the streets of Glasgow had to be looked at in a wider way. The conditions pertaining in Berlin were somewhat the same as in Kingsway in London; but the traffic there was entirely different from the traffic in the streets of Glasgow. It had yet to be proved to him that high efficiency at wide intervals was equal to lighting with a lower candle power closer, both in foggy weather and at other times. He did not like black patches in the streets. They had this with electric lighting—and it was one of its drawbacks—but they had it also, to some extent, with high-pressure gas lighting. Until he saw that high-pressure lighting was needed in the streets of Glasgow, he would be very conservative in the matter. Just now the ratepayers' pockets demanded first consideration. He would be more satisfied to see their side streets better lighted, than to go into a scheme of very high illumination. The President gave the comparative calorific value of suction gas and town gas, saying it was one-fourth. He was more than fair to suction gas; if he had given one-sixth, it would have been nearer. It was all very well to have efficiency; but they must remember the worry and the anxiety with suction gas, which they did not have with town gas.

Mr. F. L. M'Laren (Dumbarton) remarked that he had specially enjoyed the part of the address where power was dealt with, as he was particularly interested in the development of producer gas in that direction. He thought the worries with suction gas, which had been mentioned, need not be very much enlarged upon. The President referred to the use of anthracite coal at 25s. per ton. Most of the worries in connection with suction gas plant were brought about by people trying to use coal at two thirds, or almost one-half, of this price. Where good anthracite was used, there should not be much trouble or worry in the use of suction gas, as was evidenced by the number of plants being put down all over the land. They had to lay themselves open to give the public what they wanted. There was a saying in America that, whenever one came into the employment of a firm, there was one motto, and that was "Make dividend;" and no man could sin against this law and live. Those employed in corporation gas-works, or by similar bodies, had not exactly this to strive for; but they had a noble ideal to work for, which was to reduce the cost to their fellow men of what they wanted—power, heat, and light. The President referred to its being heating power, and not lighting power, which was now of importance. Consequently a cooler flame than that of town gas would be more acceptable, for cooking especially; and if people could get a gas which would burn more nearly resembling a coal-fire, more people would surely use it. There were a large number of small power users who would like to get power cheaper, and were considering a change to suction gas, but who employed power too intermittently to justify this. If these requirements existed, the removal of the smoke in cities would be a sufficient inducement to make corporations try to meet them by a supply of producer gas. This might seem a big thing; but in Staffordshire there was a large undertaking for the distribution of producer gas over an area of 120 square miles. The trunk mains were 3 feet in diameter, of steel, coated with canvas, asphalt, and another layer of canvas; and the gas was put through at a pressure of 10 lbs. per square inch. A reducing-valve was supplied to each consumer, so that he could lower the pressure to whatever he required—either for power or heating. A feature which had to be emphasized in connection with producer gas as a power agent was its easier distribution. Once it had been cooled and scrubbed, it could be conveyed any reasonable distance without much trouble, beyond that of the condensation out of the gas of water vapour, which was a good thing, and it could be easily run off. When they compared this form of distribution of power with either steam or electricity, the comparison was very much in favour of producer gas. They had simply the producer, the pipes, and the engine developing the power at the place where it was wanted; and this question of distribution was a point which engineers were always glad to welcome.

Mr. W. Wilson (Falkirk), referring to the President's remark about heavy charges, said he was right in a sense. He had himself proved that a bigger yield of gas per ton was obtained by a heavy charge of long duration than by a light charge of short duration; but he was not convinced as to the economy to be derived from it, because he was afraid that the yield of gas was secured at the expense of considerably more fuel consumption in the generator, and they did not obtain the yield per mouthpiece, which possibly debarred men in small works from adopting this method. As to where the dividing line was, he was not prepared to say. At the present moment, he was using 22 in. by 14 in. through retorts 20 feet long, with 7 cwt. charges, working them off in 4 hours 40 minutes; and he found the results were better than when working 5½ cwt. charges in 4 hours. At the same time, there was the question of fuel; and he did not know that it would be wise to increase the duration of the charges, because it stood to reason that, where they had a heavier mass of coal to heat, the heat did not penetrate so easily.

The President thanked the members for the way in which they had received his address, and hoped that the figures he had given might prove useful. Personally he attached importance to some of the figures in the tables, because they saved a great deal of time when he wanted to go into a subject and found that everything was under varying conditions, and felt that if he could get a curve, or a straight line, or even an equation, which would make the matter adapted to any case whatever, this would put it in a new light. Therefore he had prepared those equations, and they enabled him to see at a glance things which he might have been worrying over for years. Mr. Langlands made some reference to suction gas; and he thought the remarks of Mr. M'Laren were really an answer to them. It was quite clear that in Glasgow they had had no experience with high-pressure lighting, but, judging by the accounts given in the Press, the high-pressure lighting at Berlin was a marvel—in fact, they were independent of daylight altogether there. The point he made was that it had been proved, years ago, that the most economical way of distributing steam, electricity, and water, was by high pressure. Why should there be any difference with gas? It was not in the nature of things that gas should be an exception; and he was quite sure that their brethren on the Continent were on the right tack—and they would probably follow on. He was glad to hear that Mr. Wilson fully agreed with him that heavy charges were the thing. However, he put in a saving clause, and said he was only correct to a certain length. He quite agreed with him, because that was a question which had been under consideration now for years, by the most eminent men in the profession; and he believed there were scarcely two of the same mind. He was only judging, like Mr. Wilson, from personal observation; and he remembered the visit they paid to the coke-works at Kilsyth. He never saw coke like he saw there coming out of a gas-works. He was much interested lately, in the report of the meeting of the Iron and Steel Institute, with the part dealing with coke-oven distillation. Three tables were given. One contained an analysis of the gas from the coke after the coal was thoroughly carbonized. It was mentioned that the calorific value of the gas was only 411 B.Th.U. This was not good enough. The yield per ton was not given; and this made the table practically useless. In the second table was shown the composition of the gases taken off during the first half of the period. They were twelve-hour charges; and in the first six hours the calorific value given was 667 B.Th.U. Then the gas given off during the second half was more than good enough for heating. In the other table there was quoted a yield of 10,900 cubic feet per ton; and the calorific value was 551 B.Th.U. This was in coke-oven distillation. His own personal observation led him to believe that the heavier the charges the better; and he was never more convinced of this than when he saw Mr. Glover's retorts at work at Norwich. The coke there was nearly as good as that he saw at the coke-ovens.

The Association's Medal.

The President intimated that the medal provided by Mr. T. Lighbody, of Renfrew, and offered by the Association for the best paper read during the past session, had been awarded to Mr. T. H. Whitehead, of the Provan Chemical Works, for his communication on "Pumps: Their Construction and Use." The Council had agreed that the medal should be presented at their annual social in December. Mr. D. Vass, of Airdrie, had very kindly offered a medal for the best paper to be read during the present session.

South-East of Ireland Gas Association.—The annual general meeting of the Association will be held at the Waterford Gas-Works next Tuesday. The *agenda* consists of the selection of officers and the Association prize winner; a paper by Mr. J. G. Tooms, of Waterford, entitled "A Plea for the Free Maintenance of all Gas-Consuming Appliances;" and the consideration of a proposed alteration of the rules.

Manchester and District Junior Gas Association.—On Saturday the 7th prox., the Association will celebrate their tenth anniversary by combining the annual lecture and the annual dinner. The lecture, entitled "Gas Economics," will be delivered by Mr. Isaac Carr, of Widnes, at the Grand Hotel, Piccadilly, Manchester, at 3 o'clock, to be followed by the dinner and a smoking concert at 5.45. After dinner, the late Secretary, Mr. A. L. Holton, will be presented with a drawing-room timepiece, which had been subscribed for by the members as a slight recognition of his services. Any friends interested in the subject of the lecture and in the Association will be welcomed. The first "Coffee Meeting" of the Association—an informal technical and social gathering—will take place on Tuesday evening, Nov. 17, at the Cities Hotel and Restaurant, when Mr. Frank Thorp will introduce for general discussion the subject of incandescent gas lighting with high, medium, and low pressure, having special reference to personal experiments with burners and complete installations. It is stated that the proceedings at this meeting "will not necessarily be published."

CARPENTER'S GRADING APPARATUS FOR CHARGING GAS-RETORTS.

A modification of Mr. Charles Carpenter's patent No. 14,371 of 1907*—for an apparatus for charging gas-retorts with graded or sorted coal, the larger coal being in the middle and the smaller towards the outside of the charge, the finest particles of all being next the walls of the retort—is described in one of the specifications issued last week.

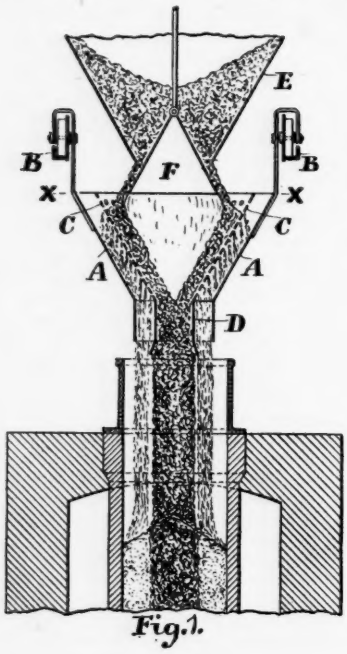
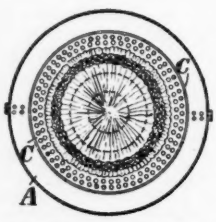


Fig. 1.



Section on Line X, fig. 1.

Section on Line Y, fig. 2.

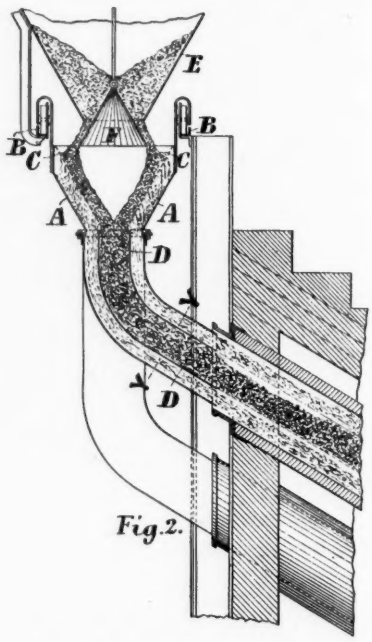


Fig. 2.

The patentee explains that the object of thus charging is "to facilitate carbonization and prevent any coal from remaining uncarbonized"—adding: "It will be understood that the finest coal is most difficult to carbonize; and hence it is desired to place it next the walls where the heat is greatest in the retort. The larger coal may be placed in the middle; and the gas therefrom will readily get away owing to the interstices between the pieces of coal being considerable and providing an easy means of exit from the mass."

Fig. 1 is a sectional elevation of apparatus arranged to charge a vertical retort and a horizontal section on the line X. Fig. 2 shows apparatus suitable for charging inclined retorts, and a cross section of the tubular mouth taken on the line Y.

The cone-shaped charging hopper A is carried on wheels running on rails B in the usual manner. Within the hopper is fixed a perforated conical screen C (so arranged as to leave an annular space between it and the walls of the hopper) terminating at its lower end in a tubular mouth D—the perforations preferably increasing in size towards its lower end or mouth. Above the charging apparatus is the coal-hopper E of taper or conical form and having within its lower end or mouth a cone F, supported from above. Its position is so regulated as to leave an annular outlet, through which the coal is fed and deflected by the cone outwardly on to the walls of the screen C. When the coal is run from the hopper over the cone on to the screen, the smaller coal passes through the perforations, and is guided by the hopper into the retort, where it forms a layer of fine material around the walls, while the larger coal passes down inside the screen and through the tubular mouth—thus forming a core of larger or coarser material in the centre of the retort.

Referring to fig. 2 (which shows the apparatus in position and in the act of charging an inclined retort), it will be seen that the hopper A is provided with a tubular curved extension for insertion into the retorts, and the tubular mouth D of the screen C is extended within the tube and held in position by radial plates. Coal is fed, as described, from the hopper E; the smaller coal passing through the screen C and down the tubular chambers, while the larger coal passes down through the tubular mouth D and forms a core of coarser material within the retort.

* See "JOURNAL" for May 26 last, p. 496.

ILLUMINATING ENGINEERING SOCIETY.

Papers at the Second Annual Meeting.

In the "JOURNAL" last week (p. 190) we published an epitome, furnished by a correspondent, of the proceedings at the second annual meeting of the Illuminating Engineering Society of America, which took place at Philadelphia early this month, and gave an indication of the nature of the papers submitted on the occasion. Some of these we are now able to notice more fully.

Illuminants and Lamps for Public Lighting.

This subject was dealt with in a paper by Mr. H. Thurston Owens. He began by quoting a remark made by Mr. Norton H. Humphrys fourteen years ago, to the effect that, though the street lamp-post is a prominent object, nobody cares what its appearance is like, "except perhaps the select few who devote the greater part of their time to grumbling in general." According to Mr. Owens, this statement describes the conditions at present obtaining in America, in the majority of cases; and he says that, strangely enough, the indifference complained of is found among engineers as well as laymen. Indeed, the former have denied having any interest in either the appearance or the type of illuminant—declaring that uniform illumination was the chief *desideratum* in street lighting. The view held by Mr. Owens is that the illuminating engineer is the man pre-eminently qualified to ensure that these matters are properly considered. He divides street lighting into five distinct groups, each of which must be dealt with on separate lines: (1) Retail business districts, (2) wholesale business districts, (3) streets in residential districts, (4) prominent thoroughfares in these districts, (5) outlying country roads. The illuminants available are electric arc and incandescent lamps and gas or naphtha mantle lamps. Some of these are illustrated.

Mr. Owens sums up as follows the lighting arrangements for the five districts with the illuminants at present available. For retail business districts, he thinks, where overhead trolleys are used, a combination of trolley and light pole, with lamps from 15 to 20 feet above the street level, are best. These should be furnished with frosted or dense opal globes; and, when so equipped, they should have a maximum lighting power of not more than 400 candles. For wholesale business districts, he thinks arc lamps will be found most satisfactory. For residential streets, the unit should not be larger than 60-candle power, mounted on posts at a height not exceeding 12 feet above the side walk, and located alternately upon opposite sides of the street. With this arrangement, gas, naphtha, or electric incandescent lamps can be used. For prominent thoroughfares in residential districts, Mr. Owens recommends arc lamps placed upon street intersections at alternate corners, and not more than 300 feet apart. For outlying districts, he thinks that the type of lamp selected is immaterial, provided it is placed zigzag fashion on both sides of the street. With regard to breakages, which are often used as an argument against the adoption of expensive lamps and fittings for public lighting, Mr. Owens states that, as a matter of fact, wilful destruction decreases as the appearance improves.

Modern Gas-Lighting Conveniences.

This was the subject of a paper by Mr. T. J. Litle, jun. He pointed out that the ignition of gas-burners can be accomplished in various ways; but it may be divided broadly into two general systems—viz., electric and pilot-light. Dealing with the former system, the author first explained the jump-spark method of

igniting, which is used where a large number of burners are to be lighted simultaneously, such as in store windows and interiors, churches, public halls, factories, &c. In this case, use is made of an induction coil of such a size as to produce a spark of sufficiently high potential to jump the distance equal to the sum of the air-gaps in the circuit. The gas is usually controlled mechanically, either by providing a gas-cock adjacent to the spark cabinet, or operated from a distance by a mechanical pull device. The latter system has been extensively used where the existing gas-piping was not conveniently arranged for the placing of the shut-off cock. Coming to the automatic electric lighter for an upright burner, the author explained that it is possible with it to place push-buttons at any distance from the burner for igniting and extinguishing. Small magnets in the cylindrical shell of the apparatus open and close the gas-cock; and the vibrating make-and-break produces the igniting spark. The ignition of the gas-burner is accomplished indirectly by a climbing pilot-light, which remains flashing only so long as the ignition button is pressed. The "pull" type of igniter is operated at the burner. It consists simply of a gas-cock to which is attached a lever and an arm carrying a wiping sparker, which ignites a flash-light. Pulling down the lever turns on and ignites the gas; pushing it up closes the cock. The two igniters just referred to are principally used in residences.

The author next described the flash-light system of igniting gas-burners, which he said was probably the most widely employed of all, on account of its simplicity, and was generally adopted for residences. It had also been applied to multiple lighting. In this case the pilot-lights are supplied with gas from an independent feed; and in igniting it is necessary merely to turn on the gas to the main-supply pipe serving the burners. When the gas reaches the mantles, it is ignited by the pilot-lights. In connection with both of the systems just noticed, the automatic clock cut-off is adapted to shop-window and other kinds of lighting where it is desired to extinguish the lights automatically at any predetermined time. In the latest application of the multiple pilot system of ignition, several inverted burners are supplied with gas for pilot-lights from a point immediately above the shut-off cock, which is concealed within the shell of the fitting. The gas is ignited by pulling the ring depending from the lamp. In the case of the pneumatic pilot ignition of clusters, the lamps are lighted in very much the same way as that above described, except that the gas is controlled by a pneumatic cock. This system has been very successfully applied to both upright and inverted single burners.

Street Lighting with Gas in Europe.

Mr. E. N. Wrightington dealt with this subject in a short paper. He told his audience that both inverted and upright mantles are used in the streets of Continental cities under ordinary and high pressure, and that the inverted lamp is giving good results; its efficiency for useful light obtained greatly exceeding that of the upright lamp. He said there were two reasons for this advantage—firstly, because the proportion of light below the horizontal, where it is wanted in street lighting, from a bare mantle of an inverted lamp is much greater than from an upright mantle; secondly, because the construction of the inverted mantle burner permits the use of reflectors which will collect the upright rays and turn them in a useful direction. Another advantage of the inverted lamp is that it lends itself to artistic treatment. A double-arm post with one lamp on each arm, and each lamp having two burners, produces a dignified and handsome effect. This combination, the posts being set at intervals of 100 feet, zigzag fashion, on each side of the street, produces a very even and effective illumination. The author considered the most striking feature of the street lighting in Europe was unquestionably the use of high-pressure inverted gas-lamps, which are found in very large units, running as high as 3600 mean lower hemispherical candle power. The posts are placed near together, and the streets are almost as bright as if lighted by daylight. As the light is diffused beautifully, the effect is very soft and pleasing.

In considering the various types of street lighting, Mr. Wrightington said a very important difference between the conditions in Europe and in America must be recognized. Wherever, in the latter country, there is traffic at night which would require such a great quantity of light as exists in Europe, very little outside illumination is needed; the streets being lighted by private citizens by means of window lamps and signs. In Continental cities, on the other hand, it is the rarest thing to find any windows lighted after dusk. The shutters are pulled down tight, and the lighting of the streets is dependent entirely upon the street-lamps. At the same time, a very great amount of light is needed, as the traffic, both on foot and by vehicles, is very heavy. For this reason, where lamps of 3600-candle power, 100 feet apart, may be necessary in Europe, it is probable that such a very large amount of light would not be needed except for special lighting in America. He thought it was entirely reasonable, however, to expect that the small units, under both high and low pressure, adjusted to suit local conditions, might be used in America.

Intrinsic Brightness of Lighting Sources.

This subject was dealt with by Mr. J. E. Woodwell, who in his opening sentence emphasized its importance in practical illumination. He pointed out that in too many instances of recent installations, the most dazzling gas and electric lamps are ruthlessly placed in such position that the eye cannot escape the glare; yet any brilliant source of light in the field of view, however small, causes a contraction of the pupil of the eye, and reduces the effect of the illumination received from other parts of the visible field. The author thus summarized as follows the more important hygienic effects of light sources of high intrinsic brilliancy within the field of vision: (1) Contraction of the pupil, thereby reducing the amount of light entering the eye and the consequent visibility. (2) Sensibility of the visual organs temporarily impaired by residual images and retinal fatigue. (3) These effects are also produced by the occasional view of bright sources or by subjecting the eye to sudden fluctuations of light. (4) Intrinsic brightness rather than the distance of the light source from the eye is the principal cause of pupillary contraction. (5) The harmful effects are greatest in proportion to the decrease in the working illumination, and are considerably reduced under an illumination exceeding 2 foot-candles. (6) The different luminous sources may be classed with reference to producing pupillary contraction and after-images in the same order as their respective intensities.

Mr. Woodwell went on to say that, in applying the knowledge of the laws of hygiene of the eye to the design of artificial illumination, the best criterion of the proper values of intrinsic brightness of the light source, as well as of other essential factors, is daylight, the most important single quality of which is diffusion. This may be obtained in artificial illumination by enlarging the area or surface of the light source, by shading the source with diffusing globes or screens, or by concealing the source and utilizing the diffuse reflection of the surfaces which receive the direct light. But whatever method may be applied in practice to secure improved diffusion and reduced intrinsic brightness of the artificial sources, it is most important to determine the values of intrinsic brightness which are both safe and advantageous to apply to the design of illumination. The intrinsic brightness of a light source is the candle power or intensity of the source divided by the area of the luminous surface.

An abnormally high illumination of 10 foot-candles on a white diffusing surface, such as white blotting-paper, gives an intrinsic brightness of the surface very little more than 0·005-candle power per square inch, neglecting absorption, which would reduce the apparent brightness to 0·004-candle power or less. Compared with such figures, the author considers the intrinsic brightness of all naked artificial luminous sources enormously high; while the values secured in actual practice by the use of shades and diffuse reflecting surfaces are generally more than ten times as great. A number of authorities regard 4 or 5 candle power per square inch as safe and admissible, and 1 or 2 candle power as good practice. While the use of even the lower of these values in artificial illuminations is questioned, it would result in a most pronounced improvement from the hygienic standpoint, and alleviate one of the principal causes of eye-strain and fatigue.

In consideration of the foregoing data, as well as from actual experience in the design of illumination, it is the opinion of the author that from 0·2 to 0·1 candle power per square inch is none too low for the safest and best practice, where artificial light sources must necessarily be placed in the constant, or even occasional, field of vision. The use of such a factor is necessarily dependent upon the local conditions, and especially upon the intensity of general illumination of the objects viewed and the corresponding pupillary aperture. The most essential point is to reduce the intrinsic brightness of all sources within the field of vision to not over 0·2-candle power per square inch of diffusing surface.

Organic Compounds in Sulphate of Ammonia.

In a letter recently addressed to the "Chemical News," Mr. F. J. Lloyd, an analyst having a laboratory in the City, directed attention to the fact that samples of sulphate of ammonia which had come before him had not been satisfactory as regards colour; and he was induced to make a study of them so as to determine whether or not they contained sulphocyanides. In some cases he found these to be present, but not in quantity sufficient to account for the coloration of the samples. Further examinations revealed the presence of certain organic compounds which were shown to be injurious to plant life. Mr. Lloyd's Assistant (Dr. Bonelli), after some work, obtained the following simple test: If a gramme of sulphate is dissolved in 5 c.c. of water in a test-tube, and strong ammonia is added, an intense violet coloration is produced where the undesirable organic compounds are present, while no change occurs either with pure gas sulphate or bone sulphate. Mr. Lloyd says the detection of sulphocyanides in the presence of these organic compounds is not so satisfactory as in ordinary sulphate of ammonia; but he found the following method gave satisfactory results: Five grammes of the sulphate were moistened with strong ammonia, and then dried in the water-oven. When quite dry, the material was ground with 5 c.c. of alcohol, and the alcohol filtered off. This was diluted with water and tested with ferric chloride; and if sulphocyanides were present, the usual bright red coloration was obtained. Mr. Lloyd thinks it behoves all who are employing sulphate of ammonia as a manure, either alone or as constituent of a compound, to make sure that what they purchase is free both from sulphocyanides and from the organic compounds which give the violet coloration with ammonia. He says one large firm in the City who are considerable users of this material have decided in future only to accept sulphate which passes these tests.

A HOT-COKE QUENCHING APPLIANCE.

Mr. P. G. Brooks, the Manager of the Telpherage Department of Messrs. Strachan and Henshaw, Ltd., of Bristol, writes as follows with respect to the article reproducing a description by Herr Gülich, of Stendal, of a coke quencher which appeared on p. 208 of last week's "JOURNAL."

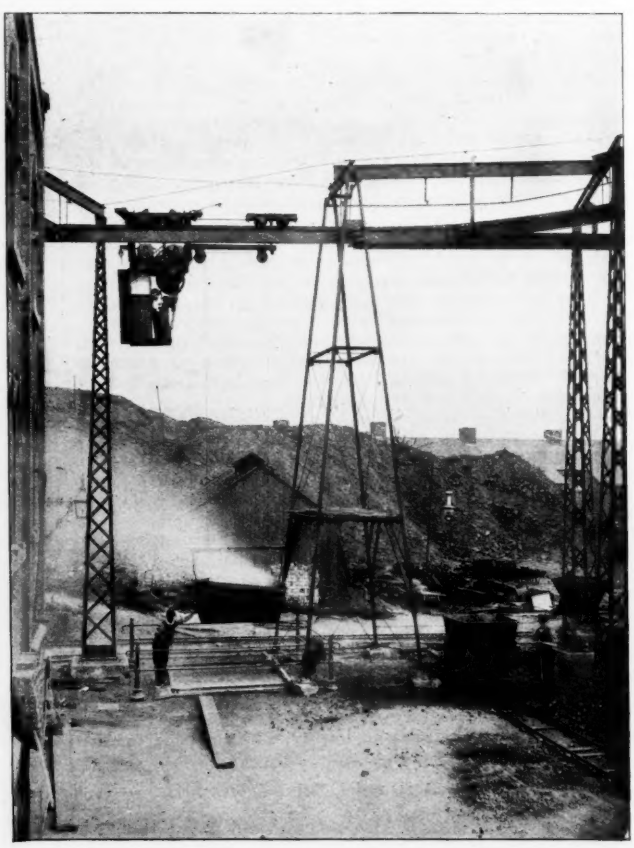
I notice in the current issue of the "JOURNAL" an article illustrating a new method of quenching hot coke—put forward by Herr Gülich, of Stendal—by completely immersing the skips containing the coke into a tank of water, for which certain advantages are claimed. I believe, however, that this method is by no means novel, and has been employed in this country for some years. Mr. Thomas Canning, the Engineer and Manager of the Newport (Mon.) Gas Company, adopted this method of coke quenching in connection with a telpher conveying plant supplied to the Company's Crindau Works by my firm in conjunction with Messrs. Siemens Bros., some 2½ years ago. I enclose an illustration of the telpher hoisting a skip of hot coke out of the tank, which may be of some interest to your readers.

In this instance, a tank was built below the ground level; and the telpher on the overhead track picks up the skip of hot coke off wheeled trucks at the end of the retort-house, and travels along with it until the skip is exactly over the tank. The driver in the telpher cabin then lowers the skip into the tank until completely immersed. He then hoists the load again, water draining out of holes in the bottom of the skip as the same is being raised; and by the time the skip is hoisted right up to the telpher, the coke is almost dry. The telpher then travels round on the overhead track, and discharges the coke on to a storage heap, or into coke-waggons on the railway; the load being first lowered almost on to the top of the heap, and the skip then tipped by means of a balanced cord arrangement from the telpher driver's cabin on the machine, thus avoiding breaking the coke, and consequent accumulation of breeze.

Telpher Hoisting a Skip of Hot Coke (After being Submerged in the Quenching Tank) at the Newport (Mon.) Gas-Works.

This quenching process was, I believe, found to be exceptionally efficient; and the value of the coke was increased. The only objection was that the coke-skip, being very hot when immersed in water, buckled somewhat and got out of shape. This, however, was overcome by using skips made by Messrs. Robert Dempster and Sons, Limited, of Elland, under Belton's patents, and constructed of narrow strips or bars of steel, riveted to cross-bars at the bottom only, and being free at the ends, which were only guided between slots provided in the top cross-bars of the skip—the bars being thus free to expand and contract without the shape of the skip being distorted.

Messrs. Strachan and Henshaw have at present in hand a similar quenching arrangement in connection with a telpher conveying plant they are supplying to the Borough of Keighley Gas Department for handling hot coke; the only difference being that in this instance the telpher conveys the coke-skips, with the load of hot coke, right from the retort-benches, and the tank is placed about 16 feet from the ground, so as to avoid the telpher having to lower and hoist the skip so far.



Telpher Hoisting a Skip of Hot Coke out of the Quenching Tank at the Newport (Mon.) Gas-Works.

We have also received the following letter, dealing with the same subject, from Mr. Thomas Canning, the Engineer and Manager of the Newport (Mon.) Gas-Works.

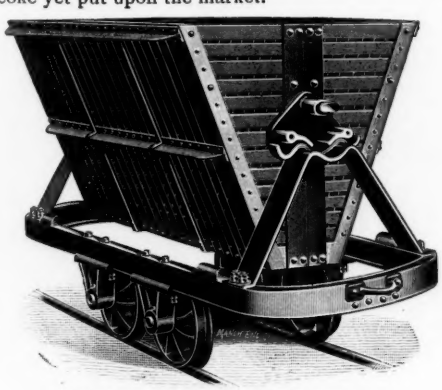
I notice in the last issue of the "JOURNAL," for Oct. 20, an interesting description of a new coke quencher. I desire to point out that there is nothing new in this coke quencher, as it has been anticipated for more than two years by a similar, but, in my opinion, much better, system introduced by myself and Mr. J. H. Canning, at the Crindau Gas-Works, at Newport. There is very little labour in

connection with the system at Crindau. The coke-tram is simply lifted off the bogey, conveyed over the tank, dipped, raised, carried to the coke-heap, and tipped; the whole of the operations being performed with almost instantaneous rapidity by the electric telpher.

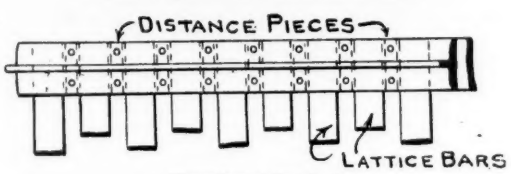
To those who may be inclined to favour this system, I may mention that it is of importance that the trams should be of the open lattice type, and that the coke should be sprinkled, if there is any distance through which it has to be carried on the bogey before reaching the dipping-tank. We have been very particular at Newport in having the tank on the ground level, because, as there is a good deal of steam disengaged, it is undesirable that it should be brought into contact with the telpher machinery, the telpher man, or the telpher track.

Should any further confirmation of these statements be desired, I shall, of course, be very glad to give all facilities for establishing the same.

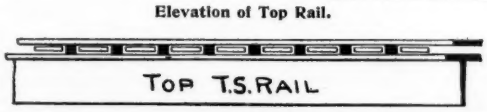
Messrs. R. Dempster and Sons, Limited, of Elland, forward the accompanying illustration of the open lattice hot-coke waggon designed and patented by Mr. J. C. Belton, the object of which is to provide a method of construction which will resist the destructive action of the work, and, by preventing buckling and distortion, prolong the useful life of the waggon. It is, they claim, a decided step in advance of any other form of conveyance for hot coke yet put upon the market.



Belton's Open Lattice Hot-Coke Waggon.



Elevation of Top Rail.



Plan showing Lattice Bars Free to Expand between the Top Rails.

The side lattice bars are riveted to the lower rail only, and move freely at the middle and top; being guided by distance-pieces riveted between the middle and top rails, and a "flat" on the inner side of each. The waggons constructed on this principle are found to have a very much longer useful life, as well as to possess the advantage of being more easily repaired; the tendency of the frame to twist and lose shape is overcome; and the weight not being excessive, the waggon is easily manipulated.

Gas v. Electricity for Destructor Lighting at Acton.—At the last meeting of the Acton Urban District Council, the question of the lighting to be adopted at the new dust-destructor buildings at North Acton was discussed at length. A proposal having been made that electricity be the illuminant, Mr. Goodhall pointed out that gas-mains were already laid to the premises, and he moved that the destructor be lighted from them. Mr. Dunsmore pointed out that the closing-down of the street arc lamps had injured the electricity undertaking very much, and if the destructor buildings were lighted by gas it would do so to a still greater extent, as every additional consumer tended to reduce the cost of electricity. The Vice-Chairman said he would never vote for the Council adopting electricity at 4d. per unit, and if this were the basis upon which they were reckoning to get a profit, he thought they were working in a wrong direction. Mr. Baldwin remarked that mains for electricity were also laid to the buildings, and though the initial cost for current might be a little more, in the long run it would be the most economical system, especially as the Council were likely to generate electricity at the destructor station. Mr. Page, the Chairman of the Electricity Committee advocated gas in the best interests of the undertaking. A few of the councillors remarked that it was hopeless to make any progress when the Chairman of the Electricity Committee used his influence against the undertaking. On a division, seven voted for gas and a similar number for electricity. Thereupon the Chairman referred the matter back to the Committee, in order that more information might be obtained as to the relative cost of the two illuminants.

REGISTER OF PATENTS.

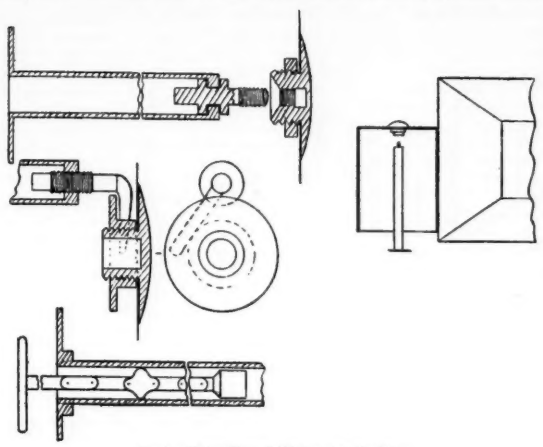
Securing Cash-Boxes of Coin-Freed Meters.

Cox, G. J., of Melbourne.

No. 10,395; May 4, 1907.

To dispense with conspicuous and sealed lock devices, and to provide a form of appliance for securing cash-boxes to the main body of a coin-freed gas-meter are the objects of this invention.

The novelty consists: (1) In attaching one end of a long metal tube, of comparatively small diameter, to the inside of the front of the cash-box drawer, or to the detachable front or to the bottom of the cash-box, which in either case forms a portion of the coin-freed meter. The tube is formed to project within the cash-box approximately the full height, length, and width of the box; and to carry upon its projected end a screw, stud, pin, or an equivalent hook-ended stem, as a portion of a fastening device, in such a manner that, when a box spanner or other screw-turning appliance is passed into the tube from the outside, the turn-screw can operate on the stem, and securely attach or release the cash-box. (2) In arranging the tube referred to so as to be applied to a cash-box or drawer as a detachable and separate fitting, and providing a flange or clip (to the end of the tube that would otherwise be attached to the box), for the purpose of causing the flange to bear on the outside plane of the cash-box front. (3) In arranging the flanged tube to act protectively—analogous to the action of a sliding bolt shaft, by passing the tube through the sides of the cash-box casing, and either through wings formed on the detachable cash-box front or through the sides of the cash-box drawer, in addition to it acting as the carrier of a portion of the cash-box fastening appliance. (4) In forming the projected end of the tube as a swivel formation, or as a nut or collar, within or against which a screw connecting stud pin or hook-ended device is actuated by the spanner or fork-ended turn-screw passed up or along within the tube. (5) Forming the box spanner or wrench of jointed links, and centring sections of such links, for the purpose of enabling a spindle of the necessary length being passed into, or withdrawn from, the tube under circumstances that would not admit the use of a spanner having



Cox's Coin-Freed Meter Cash-Box.

a rigid form of spindle. (6) Forming a lock nut provided as a portion of the complementary and fixed portion of the fastening appliance, wherein the nut is provided with a flange so as to cause the flange to form a rim catch for engaging the hook-ended portion of the coupling device carried in the end of the projected tube; or, alternatively, the complementary and fixed portion of the hook-ended appliance is formed within a hollow bolt-head shaped fitting. (7) Applying a screw stud pin as a portion of a fastening device for the cash-boxes of coin-freed meters, wherein the end of the pin screwing into the fixed portion of the appliance is formed as a right-handed screw, and the end that would otherwise be covered and turned by the spanner is formed as a left-handed screw stud end.

The illustration shows one form of the combination device employed for connecting the cash-box drawer or front securely in position, in accordance with the invention. The pin is shown permanently held in a swivel formed by two collars revolving against the inner face of the constricted end of the key-tube. An alternative form of connecting the box as a substitute for the pin is also illustrated—consisting of a hook end stopped after its turn into the locking nut by its length coming into contact with the body of the normal portion of the lock nut, as shown by the dotted lines. The way in which the cash-box is attached to the meter is also shown, as well as the specially-formed link handle for the spanner used.

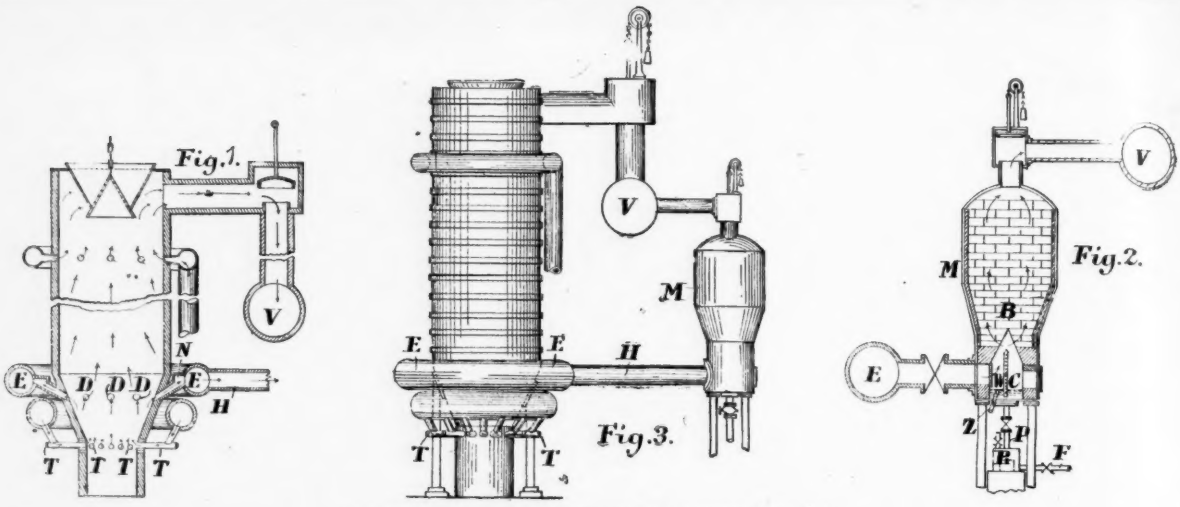
Recovery of Ammonia and Other Bye-Products from the Gases of Retorts, Coke-Ovens, and the Like.

Dunnachie, W. J., of Coatbridge, N.B.

No. 10,305; Dec. 2, 1907.

This invention relates to retorts, coke-ovens, blast-furnaces, gas-producers, and the like, in which carbonaceous or nitrogenous substance is "distilled or destructively consumed," and the resulting gas from which is treated for the recovery of ammonia and its compounds, tar, or other bye-products.

It is well known, the patentee states, that if steam and cyanide vapours at a high temperature are co-mingled, ammonia is formed; and it is further known to extract gas from the hotter regions of blast-furnaces, gas, or oil-producers, retorts, kilns, or other like apparatus,



Dunnachie's Ammonia and Bye-Products Recovery Apparatus.

and convert the cyanides contained in the gas into ammonia. But the extraction of gas from these hotter regions, and its immediate treatment with steam and water spray, for the purpose of converting the cyanide into ammonia and its recovery, together with the potash and soda, has never, so far as he is aware, been practically applied.

The object of the invention therefore is to convert what may be termed the fixed nitrogen of coal or other carbo-nitrogenous matter, cyanogen and its compounds, into ammonia, and thereby "largely to increase the present yield of ammonia from such sources." To accomplish this object, it is proposed to withdraw a proportion of the hotter gas, in the case of the blast-furnace and other force blast-furnaces from above the tuyeres. As the cyanides exist in a state of vapour, if treatment be delayed they would be deposited; and so the gas, immediately after its withdrawal and before its temperature has been greatly reduced, is caused to mix intimately with steam and water spray and, in certain contingencies, a small volume of air, and thereafter to be passed through water, in an external vessel, as hereafter described.

Fig. 1 illustrates in vertical section a blast-furnace to which the improvements are applied. Fig. 2 is a vertical section of a mixing vessel or apparatus designed to be used in connection with the furnace illustrated in Fig. 1. Fig. 3 is an elevation of the plant embodying the apparatus illustrated in Figs. 1 and 2.

In carrying out the process (say) for treating the gas withdrawn from the hotter regions of a blast-furnace as shown in fig. 2, the hot gas is caused to meet with an atmosphere of steam and water spray immediately on entering the mixer M at the point W, whereby the cyanogen (free or combined) present is converted into ammonia in its passage through the checkerwork B of the mixer. A water spray is introduced on the top of the checkerwork, down which it trickles and collects at the bottom in the chamber C, and from which it is periodically drawn off by the pipe P into the receiver R and, by means of the pipe F, is again circulated through the checkerwork. This water in its passage through the checkerwork washes the ascending gas and dissolves out the potash and soda which gradually concentrates therein, and is from time to time reduced in strength by the withdrawal of a proportion of the concentrated liquor and fresh water to an equal amount introduced. The concentrated liquor is evaporated down to dryness for the recovery of the potash and soda so extracted. The object of the checkerwork is to secure intimate diffusion of the gas and steam, and thus to prevent the escape of unconverted cyanide and of the resulting alkalies. The ammonia and gas mixture passes into the green-gas main V for conveyance to the recovery plant. Where such plant does not at present exist, the hot gas, ammonia, and steam may be immediately passed through sulphuric acid, whereby the ammonia is converted into sulphate of ammonia and the escaping gases reintroduced to the furnace, or else conveyed through suitable condensers and distributed for consumption where required.

The loss of heat sustained by the furnace, retort, coke-oven, or the like, by the gas extraction, may, when necessary, be made good by the introduction of an excess of combustible material with the charge or by the introduction of superheated gas above the level of the point of extraction. In the example shown, openings D are made into the interior of the furnace in the hotter regions above the tuyeres T, into which are inserted brick-lined tubes N, connecting at their outer extremities with a brick-lined horse-shoe main E for the reception of the escaping gas. From the main a brick-lined iron tube H connects with what is termed the mixer M. This is a brick-lined chamber filled with brick checkerwork, or other intersticed material, the object of which is to ensure the intimate mixture of the hot gas with steam and water spray, and, when required, a small volume of air, for the purpose of converting the cyanides into ammonia. The steam and water spray enter by the pipes W, which are perforated by a series of holes so as more effectually to secure this intimate mixture, and are so fixed as to bring the steam and water spray into contact with the hot gas immediately on its entering the mixer and before it has greatly cooled. When required, a small volume of compressed air is blown in by the horizontal pipe Z perforated on its upper side. The rush of air produces a further spray of water.

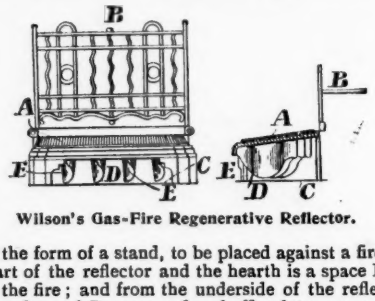
Heat Reflector for Gas-Fires.

WILSON, H. (Wilsons and Mathiesons), of Leeds.

No. 22,519; Oct. 12, 1907.

This invention relates to a device comprising a heat reflector provided with air-heating bars beneath, so arranged as to heat the air passing to the fire and give an increased efficiency. The device may be termed a "regenerative reflector."

The patentee proposes to utilize a great proportion of the heat from a gas-fire that is radiated on to the hearth (between the curb and the fire) by means of a deflector A, placed at a suitable angle from the base of the fire B to the hearth C. A space is left under the reflector whereby the air to the burners becomes heated. The reflector is made of copper, in any desired form; the metal being preferably corrugated,



Wilson's Gas-Fire Regenerative Reflector.

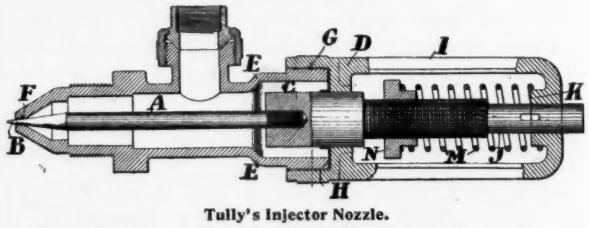
and made in the form of a stand, to be placed against a fire. Between the lowest part of the reflector and the hearth is a space D, up which air passes to the fire; and from the underside of the reflector depend bars or plates of metal E, arranged as baffle-plates, so as to cause the air to take a sinuous course. As the reflector becomes heated, so will the metal bars, and as the air passes in contact with them, it will be heated, and pass hot or warm to the burners.

Injector Nozzles.

TULLY, C. B., of Wood Green, N.

No. 23,139; Oct. 19, 1907.

The patentee's proposal is to automatically dislodge material that may tend to accumulate in a nozzle adapted to deliver liquid (such as tar or heavy liquid hydrocarbons) to a gas generating plant or the like, by providing the nozzle with a reciprocating clearing device adapted to be automatically moved backward by the pressure of the liquid directly supplied to the nozzle for delivery therefrom, and forward by a spring or other motor when the pressure of the liquid is reduced or removed. The liquid is supplied to the nozzle in an intermittent manner, by a reciprocating pump, so that during the working of the pump the clearing device will automatically be caused to reciprocate in the nozzle and keep it clear of obstruction.



Tully's Injector Nozzle.

In the nozzle shown, a clearer A, having a pointed extremity B somewhat resembling a needle valve, is screwed into a plunger C arranged to slide through a cap D employed to close the end of the nozzle casing E remote from the discharge orifice F. The cap is secured to the nozzle casing by screw-threading the co-acting parts as at G, and screwing them together; a fluid-tight joint being obtained by an interposed washer H, which may be cupped to embrace the plunger and prevent leakage between the latter and the aperture in the cap or casing through which it is free to slide. The nozzle-cap may also have a yoke or skeleton frame I, one end of which serves as a guide for a tail-piece J or rearward extension of the clearer plunger, and has an abutment K for a spring M, which encircles the tail-piece or extension and re-acts against a nut or collar N adjustable in position along the tail-piece or extension, as by screwing.

The arrangement is such that the spring tends to force the clearer through the discharge orifice of the injector nozzle, and in so doing

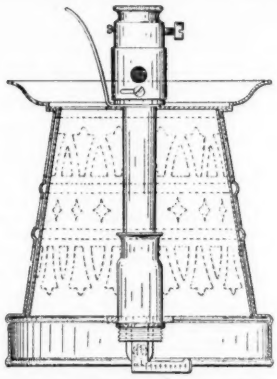
dislodge any foreign matter present there. This will happen at each suction stroke of the pump, while upon the delivery stroke the liquid will move the plunger against the action of its spring and retract the clearer sufficiently to permit the liquid to be discharged through the nozzle.

Inverted Gas-Lamps.

BIHELLER, S., of Chiswell Street, E.C.

No. 28,393; Dec. 24, 1907.

In lighting by inverted incandescent gas-lamps (as the patentee points out), it is usual to have the lower part of the chimney of glass, while so much of it as projects above the gallery for the globe is of metal and frequently formed in one piece with the gallery and various other parts—thus the upper part, when the lamp is lit, prevents any light issuing above the gallery (the latter being frequently on a level



Biheller's Incandescent Burner Shade.

with a non-transparent reflector). This keeps the upper part in darkness—"at the very time when the lamp should be most effective." He proposes to obviate these disadvantages by making the chimney above the gallery of perforated metal, and lining it with transparent material, such as glass, mica, or translucent china; the perforations forming a pattern (as shown) harmonizing with the general appearance of the lamp.

Manufacture of Coal, Water, or Oil Gas.

MORGAN, W. H., DENSLEY, J., GRAY, H., and GEERING, G., of Weston-super-Mare, and WALDUCK, H. J., of Birmingham.

No. 10,558; May 15, 1908.

This invention relates to a process for the manufacture of coal gas, water gas, or oil or carburetted water gas (or combinations of such gases) for illuminating, heating, and power purposes.

One of the essential features of the invention consists in generating either producer gas or water gas, and firing it in specially constructed chambers containing the retorts for the manufacture of coal gas, and, after the production of the required heat for the carbonization of the coal, shutting off the supply of air by which the combustion of the producer gas or the water gas is maintained, and conducting the water gas through specially constructed chambers into the washer, condenser, and holder—the water gas mixing in the washer with the coal gas produced. Or the apparatus in which the process is carried out may be so worked as to produce coal gas alone, or water gas alone, or carburetted water gas, or a mixture of the latter with coal gas.

The generator A differs in no essential respect from that of an ordinary water-gas plant; and one or more (preferably two in series) specially constructed chambers B B^1 contain the coal-gas retorts. These chambers (referred to as the "combined carburettors and carbonizers") are in combination with hydraulic mains C and a special form of washer D, from which the gas as produced passes by the pipe E to an ordinary condenser and gasholder.

The combined carburettors and carbonizers are each formed of a cylindrical metallic case with a fire-clay lining, and are divided by radial reticulated fire-brick walls into six inter-communicating compartments, in each of which one of the series of vertical coal-gas retorts F is arranged. These retorts have a slightly-tapering form; being larger at their lower ends than at their upper ends. The reticulated walls are preferably built on radial fire-clay bars supported a short distance above the bottom of the carburettor and carbonizer (as is best seen in the detail view of the lower part of one of them), so as to obtain a nearly clear space at the bottom of each.

For the production of oil gas, a spraying device for the liquid hydrocarbon is fitted in the axial opening in the upper end of one or both carburettors and carbonizers. The upper ends of the retorts communicate with the hydraulic mains by the pipes G dipping into the liquid in the mains.

The washer D is provided with a water-spraying device at the top, and with three water-tanks at the bottom. The hydraulic mains lead the coal gas bubbling through the liquid in the mains into the side tanks; the water or carburetted water or oil gas being delivered by the pipe H into the middle tank.

When manufacturing coal gas, the retorts F having been filled with coal and a fire in the generator A having been started and the generator charged with coke, a blast of air is admitted by the pipe I to the generator, so as to bring the coke in it to a state of incandescence. The producer gas obtained thereby passes by the connections K into the chambers B B^1 respectively, in which it is fired by admixture with air; the heated air and products of combustion passing into the pipe H communicating with the stack L, by which the heated air and products of combustion escape into the atmosphere. By the combustion of the producer gas and passage of the heated air and products of combustion through the carburettors and carbonizers, the temperature of the latter is "considerably and quickly raised."

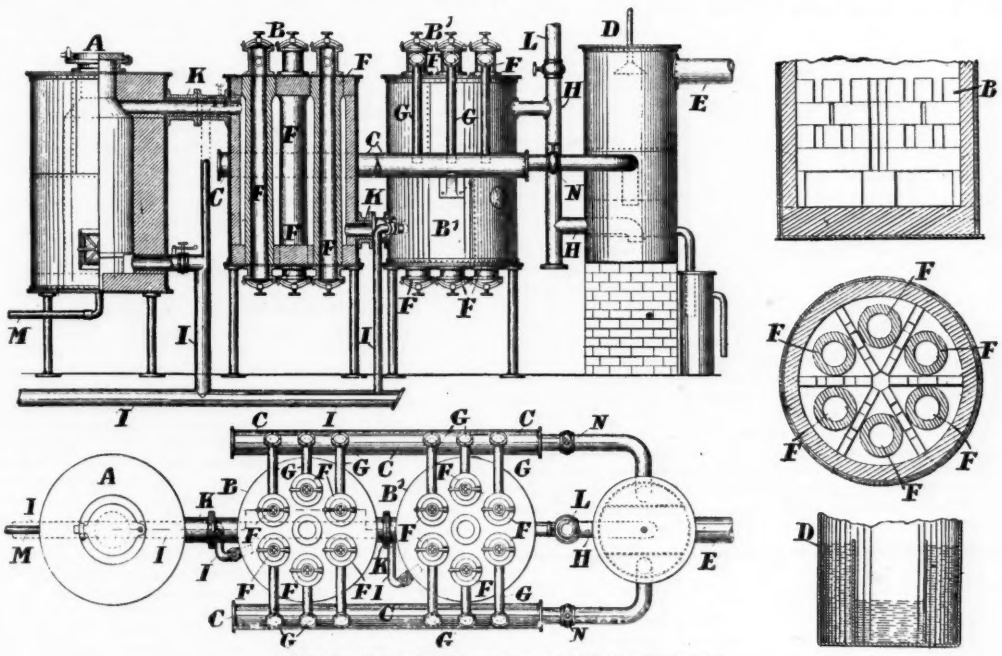
After a short time the valve on the pipe I is closed, and the supply of air to the generator A is thereby shut off. At the same time steam under pressure is admitted by the pipe M and blown through the incandescent fuel in the generator, so as to produce water gas, which may be fired in the carburettors and carbonizers by the admission of the air-blast to the chambers should it be ascertained by an inspection of their interiors that they have cooled down to too great an extent—the necessary temperature being maintained by firing the water gas.

By this process the carbonizing of the coal in the retorts F is "very quickly effected," and the coal gas produced passes over to the hydraulic mains C and to the side tanks of the washer D, and from the washer, by the pipe E, to the condenser and holder.

The coke from the retorts at the end of the process is transferred to the generator A when next charging it, and hence there is "practically no waste of fuel."

When it is desired to manufacture water gas alone, the retorts F are not charged with coal, and the water gas is not burned in the carburettors and carbonizers—being passed wholly through them and to the pipe H; the valve of the stack L being closed, so that the gas passes into the middle tank of the washer D.

When it is desired to manufacture a mixture of coal gas and water gas, the sequence of operations is modified by the shutting off of the supply of air to the carburettors and carbonizers and closing the stack



A Combination Coal, Water-Gas, and Oil-Gas Generator.

valve as soon as they have acquired the proper temperature for the carbonization of the coal in the retorts.

When oil or carburetted water gas is to be manufactured, either alone or as a mixture with coal gas, an oil-spraying device is applied to the carburettors and carbonizers at the axial openings in the tops of the chambers B B^1; and when the chambers have been raised to the required temperature for the destructive distillation of the liquid hydrocarbon to be used, it is sprayed into the chambers.

The proportion of the mixture of coal gas and water gas or coal gas and carburetted water gas may be regulated by valves N.

Charging Gas-Retorts.

CARPENTER, CHARLES, of Old Kent Road, S.E.

No. 27,186; Dec. 9, 1907.

This invention is illustrated and described on p. 280 of to-day's issue.

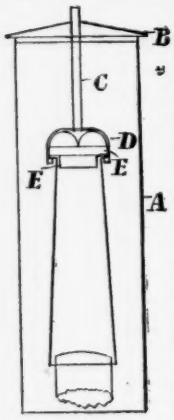
Incandescent Gas-Burners.

JACKSON, S. A., of Salford.

No. 227; Jan. 4, 1908.

This invention relates to mantle supports for incandescent gas-burners consisting of a bridge, an adjustable hanger, a deflected cap, and a mantle ring—all as shown in the engraving.

The chimney or globe A is fixed on a burner of ordinary pattern and of greater height than the mantle top, B is a bridge or support, of non-combustible material, across the top of the chimney. C is a connector (adjustable in length), either a spring, rod, or loop of non-combustible material. To it is attached a deflector cap or dome D, of fire-clay or other refractory material, whose diameter does not exceed one-half the diameter of the chimney. The dome has projections on, or holes in, its large diameter; or else its arms projecting downwards. The mantle is fitted at its head with a ring, or portion of a ring, of non-combustible material E, having projections on it to enable the mantle to be attached to the dome by a cage of non-combustible material, by arms from the ring being extended to engage with the dome, or else projections to meet the arms depend from the dome. The object is to form "an even lateral opening between the head of the mantle and the bottom edge of the dome approximately one-eighth the diameter of the bottom edge of the dome."



Jackson's Mantle Supporter.

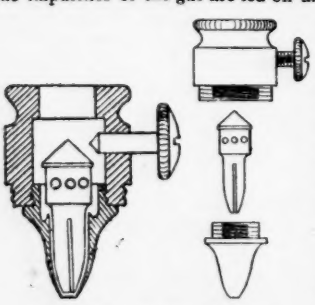
It is said to have been found by experiment that the opening being regular and of the proper size, "a more even incandescence of the mantle and greater durability ensues; also the diameter of the dome being approximately one-half that of the enclosing chimney, the current of air is not impeded, and the combination gives a steady, even incandescence to the full height of the mantle." The mantle being suspended from the dome to a bridge across the top of the chimney allows for easy removal for cleaning purposes; and the connector C, being adjustable, allows for various lengths of chimneys to be used and still maintain the correct height of the mantle.

Inverted Incandescent Gas-Lamps.

EBERHARD, T., of Friedenau, near Berlin.

No. 10,782; May 18, 1908. Date claimed under International Convention, May 17, 1907.

This gas nipple or nozzle is provided with a regulating device so that the impurities of the gas are led off along a deflecting surface on that part of the nipple which can be raised and lowered from the outside of the nipple to a collecting space lying as much as possible away from the passage of the gas. Thus the impurities, after they have once been eliminated, are not, "as far as this can be prevented, again drawn into the passage of the gas."


Eberhard's Inverted Gas-Nozzle.

The deflecting surface (as shown) may either be detachably or rigidly connected to the part of the nipple which can be adjusted with regard to its height—the so-called regulating-needle or regulating spring. The deflecting surface is preferably of the form of a conical roof, and is used, at the same time, as a gliding surface for the regulating-screw; and it is preferably arranged above the openings through which the gas streams into the lower part of the nipple or into the inside of the hollow nozzle springs. On the other hand, the collecting space for the impurities is arranged below the openings through which the gas streams in, or else at the side, and as far as possible removed from them. The lower part of the gas-regulating nozzle, with the space for collecting the dust, is preferably detachable, in order to facilitate the cleaning of the nozzle.

We have received from Messrs. C. & W. Walker, Limited, a neatly-printed pamphlet containing illustrated descriptions of Milbourne's patent purifiers and valves and other plant, including his automatic "Safety" discharge shoot, which was described in the "JOURNAL" a fortnight ago. The particulars are followed by some useful notes on the design of purifiers.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas Making in Mond Producers.

SIR,—We notice in your issue of the 13th inst. another editorial on the above subject, which gives as the reason for discussing the matter a most interesting and valuable paper read by Professor Bone and Mr. Wheeler before the Iron and Steel Institute. In this case, however, the authors leave out any mention of the name "Mond;" but, for some reason or other, you consider it desirable to draw it again into discussion. We much appreciate the excellent series of results which the authors have given, since their figures all round clearly show the very superior results which we always claim for the Mond producer—such results having been obtained by them under the most varied conditions of operation.

We should not have considered it necessary to refer to your article but for the fact that we are the owners of the Mond patents in this country, and therefore feel compelled to reply to your remark that "it would be interesting to know in how many of the existing Mond gas plants ammonia recovery is still practised, and what is the average yield per ton of coal." All the Mond plants erected for the purpose of recovering ammonia are still operating under those conditions, producing a thoroughly good producer gas containing, on an average, 150 B.Th.U. per cubic foot combined with an all-round recovery, in the form of sulphate of ammonia, of between 70 and 80 per cent. of the nitrogen contained in the slack; the usual yield being between 85 lbs. and 105 lbs. of sulphate of ammonia per ton of fuel gasified.

These facts speak for themselves; and it is well known that Mond gas is being used successfully in all parts of the world for the most varied metallurgical and other purposes requiring the highest temperatures. On the other hand, we would ask you to state the average calorific value of gas made by gas-producers in lighting-gas works which you mention in your article. We have no doubt that it is considerably less than that above mentioned, despite the fact that such producers work under conditions you consider to be so superior.

In one particular the authors confirm most clearly what we have always maintained—viz., that, though Mond gas as a producer gas is already distinctly good, its calorific value is considerably increased on passing through the regenerators of furnaces, which is not the case with ordinary heating producer gas.

We would suggest, Sir, that when you contemplate writing articles upon Mond gas you might be good enough to ask us for any information you require, and we shall be most happy to give you all facilities in our power to become posted in actual facts.

ARTHUR H. LYMN,
Power Gas Corporation, Limited.

39, *Victoria Street, S.W., Oct.* 20, 1908.

[Reference is made to this letter in an article on another page of to-day's "JOURNAL."—ED. J.G.L.]

Decreasing Average Income per Unit.

SIR,—I could not help thinking, when reading your "Electricity Supply Memoranda" in the "JOURNAL" for Oct. 20, how closely it agreed with the warning contained in my paper to the Irish Association in August last.

If your criticism of the West Ham electrical undertaking be read carefully through, and especially the portion relating to decreased average income per unit sold, there will be found a great similarity with that portion of my paper commencing: "In stating these views, the author has been told nothing is lost by these low rates" (found at the bottom of p. 456, Aug. 18).

Wriggle as one will, there is no getting away from the fact that large difference of price to different consumers in any one undertaking reduces the average prices received, and profits made, per 1000 cubic feet. Therefore, as an absolute necessity, the higher rated consumer is kept at such a price to secure the necessary profits, with the added capital charges for extra meters, services (and often increased mains), cookers, &c., a problematical time—till the increased consumption reduces working costs sufficiently to give the higher rate relief. All the time—mark you—this low-rate consumer has been receiving a benefit from plant he did not help to buy.

Your editorial on p. 437 of the same issue, even encourages this unsound system in gas supply, while criticizing our rivals at West Ham.

Wicklow, Oct. 24, 1908. J. F. TYNDALL.

Riveting Services to Steel Mains.

SIR,—As makers of the Woodall and Parkinson expansion-nipple, may we be permitted briefly to reply to the criticism of Mr. Walter Hole, in his lecture before the Yorkshire Junior Gas Association, as reported in your last issue. Mr. Hole suggested—(*a*) that this connection at the main might be disturbed by the subsequent attachment of service lengths; and (*b*) that the same could not be released if it were required to enlarge or discontinue the service.

Apparently these two strictures are opposed to one another and might be allowed to self-eliminate. But it is obvious that Mr. Hole intended only to imply a slight loosening in the first case; and it is this useful criticism which we desire to test by the following explanation.

The British Mannesmann Tube Company have always claimed that an ordinary tapping connection in their thin steel tubes is as strong as the same in a cast-iron pipe of more than double the thickness. We believe that this is correct when the connector is also of Mannesmann steel, and when the work is done by a skilled man in a fitting shop. But rough workmanship and varying threads in open-air practice have led to the almost universal demand for something better. Both the Mannesmann thickened section and Woodall and Parkinson expansion

nipple have been devised to meet this demand. The latter invention retains all the advantage of the screw-thread with the addition of the riveting or locking process. The nipple is tapered at the end, so that it screws down to a finish; and when subsequently expanded on the inside of the main, it cannot be moved by any ordinary means either in or out. If great force were applied in order to shift it, the effect would be to tighten rather than to loosen it, whichever way it was turned.

It has been pointed out in recent American papers on high-pressure distribution, that a tapered thread screwed into a parallel socket or hole is technically incorrect as a joint, because in the result there is really only one thread quite tight. The taper in the expansion-nipple is corrected by its subsequent enlargement at the end within the main; and therefore the ultimate bearing of the threads is complete and sound throughout. When once the nipple is fixed, it becomes part of the main, just as the branch of a tee, and can be plugged or capped if not required. For enlargement of service, a fresh hole must be tapped in the main, or when used for gas it would often be sufficient to attach an enlarging socket to the existing nipple.

When we first started to manufacture the expansion-nipple, a few samples were made out of best hydraulic wrought-iron tube; and it was found that this material would not expand without splitting and breaking. Mannesmann steel tube, which is now exclusively used, will expand cold to a much greater extent than is required of it by this process, without any sign of fracture; and this again is not only an indication of the superior nature of Mannesmann steel, but is a guarantee of the great strength and soundness of the expansion-nipple joint. In addition to this, there are the saddle and packing-ring, which form a second line of defence against disturbance or leakage.

Deptford, Oct. 24, 1908. J. STONE AND CO., LTD.

Metropolitan Water Board's Charges.

SIR,—The present agitation for a reduction in the water-rate will, if successful, prove of no benefit to the consumer. The Water Board cannot pay its way with a 5 per cent. rate; consequently it cannot do so with a smaller imposition. The ratepayer must, therefore, make good the deficiency in another way and under another name.

Obviously, the Board's working expenses are excessive, and they are trading in a way that would land a tradesman in the Bankruptcy Court in a few months. The cause of their present position is that, while their ship has from the first been overmanned, there are now, right throughout their system, three men where two should be sufficient. When the Board took over the business of the Water Companies, and until the 1st of April last, they had eight distinct districts to supply, with eight separate and complicated systems of rating, which necessitated constant surveys of the houses served to ascertain where there were high services, baths, and other extras, followed by intricate investigations, reckonings, &c. Naturally, this meant the employment of a small army of experienced servants. Now, however, that there is one uniform charge of 5 per cent., without extras, a few schoolboys could do what is necessary. All they need know is that they are to charge 1s. in the pound on the poor-rate assessment. The process is mechanical and simplicity itself. Does it not follow that at the present moment at least 30 out of every 100 of the Board's servants must be doing nothing? If it reduced its expenditure to a normal condition, the Board could, without any further statutory powers or requirements, pay its way by a 3 per cent. rate.

57, *Gracechurch Street, E.C., Oct.* 19, 1908. GEORGE KEBBELL.

SIR,—The statistics quoted by the Chairman at yesterday's meeting of the Metropolitan Water Board are strikingly inaccurate. He must have been the victim of some informant who had collected the particulars in a very perfunctory manner. The writer has carefully perused the authentic abstract of accounts of the Board for the year ending March 31, 1907, and collected therefrom the items under "Salaries" and "Wages." These together amount to £418,897, exclusive of "Superannuation" and "Compensation for abolition of office," totalling £49,343. Yet the Chairman claims that the Board are saving £5000 per annum in salaries; forgetting that, even if this were accurate, the sum paid for salaries should have been reduced by at least £50,000, for they escape over £30,000 paid in Directors' fees, besides the salaries of six Chief Engineers of the Water Companies. Your readers will be interested to hear the Chairman's explanation of this. The same accounts show that for the year in question the expenditure exceeded the income by £344,910. The accounts for the year ended the 31st of March last have not yet been audited. Why?

The Chairman could not resist boasting that the Board supply gratis water for extinguishing fires. Surely he should know that this has been the case from the very inception of water companies. It was by the offer and undertaking to so supply water that Parliament was induced to give these companies their enormous powers. In fact, the Incorporating Acts of the old companies (which were nearly all passed about a hundred years ago) recite in the preamble that the principal object of the formation of the company is to supply water gratuitously "in case of accidents by fire" which "exposed the inhabitants to the most calamitous losses and inconveniences." In other words, the original enterprisers posed as philanthropists. So this particular part of the Chairman's statement has no bearing upon the question of excessive charges.

57, *Gracechurch Street, E.C., Oct.* 24, 1908. GEORGE KEBBELL.

Charge against a Gas Company's Accountant.—At Brentwood, last Friday, Cecil Harry Earthy, aged 37, Accountant and Clerk to the Brentwood Gas Company, was charged with fraudulently embezzling and stealing £50, and other sums amounting to £70, received by him for, and on account of, his employers. The prisoner absconded some weeks ago, and was ultimately arrested at Swanley. Evidence of arrest having been given, prisoner was remanded in custody until Thursday.

LEGAL INTELLIGENCE.

BRAY'S REVERSIBLE INCANDESCENT BURNER.

High Court of Justice—Chancery Division.

(*Before Mr. Justice* SWINFEN EADY.)

Last Tuesday, his Lordship had before him an action in which Messrs. George Bray and Co., Limited, sued for an injunction to restrain Messrs. Weiss and Biheller, who carry on business in Chiswell Street, from selling inverted reversible incandescent gas-burners in infringement of their patent No. 19,395, of 1905, or any colourable imitation thereof, and for damages on account of profits, and the delivery up of all infringing articles. The defence (in terms) denied infringement; but it was practically admitted that the burners sold by the defendants were an exact copy of the plaintiffs', made in Germany. A number of anticipations were alleged; but the main point of the defence was that the patent was invalid for want of subject-matter.

Mr. ASTBURY, K.C., Mr. WALTER, K.C., Mr. GORDON, and Mr. H. MOULTON appeared for the plaintiffs; Mr. J. H. GRAY represented the defendants.

Mr. ASTBURY, in opening the case, explained the nature of the invention, the object of which was, he said, to produce an inverted bunsen burner which could be attached to an existing bracket, whether it pointed upwards or downwards, without the necessity of using an adapter or swan-neck to place the burner in the position desired. The utility of the invention was shown by the large number sold.

Professor *Vernon Boys*, one of the Metropolitan Gas Referees, gave evidence as to the utility and novelty of the invention; and he adhered to it throughout a lengthy cross-examination.

Mr. *G. Brookes*, the Manager of the Gas Department of Messrs. Gratorex, of Manchester, said his firm had sold from 15,000 to 20,000 of the patent burner in the last three years, since it came out.

Mr. *Arthur Bray*, the Manager of the Commercial Department of the plaintiff Company, said the burner had been very successful, some thousands per week having been sold.

Mr. GRAY then opened the case for the defendants, resting it mainly on the want of subject-matter.

Mr. *James Swinburne* was called, and said that in his opinion the plaintiffs' device, as described, was simply an inverted burner which contained within itself something in the nature of an adapter, so that it could be attached to a nipple pointing either upwards or downwards. In his own house he had adapted an inverted burner to an upward-pointing bracket by unscrewing the end half-a-turn. There was no difficulty about it.

The cross-examination was not concluded when the Court rose.

On the resumption of the hearing on Wednesday morning, Mr. Swinburne was further examined; but no other witness was called on the defendants' behalf.

Mr. GRAY having addressed the Court,

Mr. WALTER replied, and his LORDSHIP reserved judgment.

On Friday, the case was mentioned by Mr. WALTER, who stated that the parties had met and arranged terms, including a licence. He therefore had to ask his Lordship for an injunction, without costs.

His LORDSHIP made the order as required.

QUESTION AS TO A DOMESTIC SUPPLY OF WATER.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

(*Before Mr. Justice* EVE.)

This was an action brought by Mr. Richard Frederick against the Bognor Water Company to obtain a declaration that he was entitled to a supply of water for domestic purposes at ordinary rates. After the writ was issued, a special case was agreed to be stated for the opinion of the Court; and it came before his Lordship last Wednesday.

Lord ROBERT CECIL, K.C., M.P., and Mr. BETHUNE appeared for the plaintiff; Mr. P. OGDEN LAWRENCE, K.C., and Mr. CUNNINGHAM GLEN represented the defendants.

Lord ROBERT CECIL said the plaintiff was the occupier of a large house used as a boarding school, with stables and laundry attached, at Pagham, Bognor; and he claimed that he was entitled to a supply of water for the use of the school and the laundry at the rates specified in section 60 of the Company's Act of 1891—viz., where water was supplied for domestic purposes. The defendants contended that he could not require them to supply water in this way, and that they were not bound to provide him with water otherwise than by agreement. Section 61 of the Act set forth that the Company should not be compelled to supply water to the occupier of any dwelling-house otherwise than by agreement, where any part of such dwelling-house was used for any trade, business, or manufacture for which water was required. Therefore the only question in the case was upon what terms plaintiff was to have water. The defendants submitted that he was carrying on business, and that therefore they were not compelled to supply him with water otherwise than by agreement. He contended that it was not true to say that the plaintiff was carrying on a trade, manufacture, or business for which water was required, because he only wanted it for domestic purposes, such as washing and drinking.

Mr. LAWRENCE thought the only point which his Lordship would have to decide was whether this boarding school was a "business" for which water was required. The case showed that the plaintiff expected to have 40 pupils; and necessarily he would want more water than if it was an ordinary occupation dwelling-house. Too much stress ought not be laid on the words "for domestic purposes." If a business required a supply of water for domestic purposes, it was none the less one for which water was needed. The plaintiff's business was that of making a home for boys, and he charged accordingly.

His LORDSHIP reserved judgment.

MISCELLANEOUS NEWS.

GAS COMPANIES' PROTECTION ASSOCIATION.

The Eleventh Annual General Meeting of the Association was held last Wednesday, at the Westminster Palace Hotel, Victoria Street. The CHAIRMAN (Mr. H. E. Jones) presided. The other members of the Committee present were: Mr. Thomas Berridge (Leamington), Mr. Charles E. Botley (Hastings), Mr. George Clarry (Cardiff), Mr. W. F. Cotton, J.P. (Alliance and Dublin Consumers' Gas Company), Mr. H. Hart (Canterbury), Mr. Douglas H. Helps (Reading), Mr. William King (Liverpool), Mr. R. O. Paterson (Cheltenham), Mr. W. R. Phillips (Hitchin), Mr. S. Y. Shoubridge (South Suburban Gas Company), and Mr. Hanbury Thomas (Sheffield). Ordinary representatives present were: Mr. Edward Allen (Liverpool), Mr. William Belton (Shrewsbury), Mr. A. E. Broadberry (Tottenham), Mr. C. W. Braine (Wandsworth), Mr. T. H. Duxbury (South Shields), Mr. T. H. Hazell (Newport, Mon.), Mr. J. T. Jolliffe (Ipswich), Mr. T. May (Richmond), Mr. C. M. Ohren (South Suburban Gas Company), Mr. H. Townsend (Wakefield), and Mr. Arthur Valon.

THE LATE SIR GEORGE LIVESEY.

With all present standing,

The CHAIRMAN said that they were assembled that day under a cloud of affliction. A great loss had befallen the gas industry and the Association in the death of their Vice-President, Sir George Livesey. For the moment, before proceeding with the business of the meeting, all he (the Chairman) asked was that they should approve of the following resolution being sent to Lady Livesey, which put on record the value attached to the work of their late Vice-President, and their deep sympathy with Lady Livesey:—

> That this meeting desires to record its deep sense of the loss the Association has sustained by the death of its Vice-President, Sir George Thomas Livesey, and to acknowledge the invaluable services he ever ungrudgingly rendered to it as well as to the whole gas industry throughout his long and distinguished career, and further respectfully offers its sincere sympathy and condolence to Lady Livesey in her sad bereavement.

The members silently endorsed the resolution.

GENERAL BUSINESS.

The SECRETARY (Mr. Fred. E. Cooper) read the minutes of the last annual general meeting, and of the special general meeting held on Feb. 6; and they were confirmed.

It was mentioned that letters of regret at inability to attend had been received by the Secretary from Mr. Corbet Woodall, Mr. Frank Bush, and Mr. E. W. H. Eady.

ANNUAL REPORT.

The SECRETARY next read the Committee's annual report and the accounts. The former was as follows:

The Committee have pleasure in presenting the revenue account and balance-sheet for the year ending October, 1908, with a report of the proceedings of the Association during that period.

The revenue account shows that the receipts for the year amounted to £597 19s. 8d., and the expenditure to £340 12s. 2d., leaving a credit-balance on the year's working of £257 7s. 6d. In this connection, however, it should be stated that there is a liability in connection with the promotion of the Standard Gas-Burner Bill, subsequently referred to, the amount of which cannot be ascertained until the matter is finished.

The balance-sheet shows that the Association's assets amount to £1886 13s. 10d., represented by £1372 11s. 2½ per cent. consolidated stock at cost price, balance at bank £507 5s. 11d., cash in hand £6 16s. 11d.

In accordance with the instruction given to the Committee at the last annual general meeting, to consider the desirability of promoting a Bill making provision for uniform gas testing, the Committee duly considered the matter, with the result that they gave instructions for a draft Bill to be prepared, and appointed a Special Committee to deal with the matter. The Bill, as finally approved by the Special Committee, was submitted to the Institution of Gas Engineers, who were invited to co-operate in the promotion of the Bill.

The Special Committee of this Association having the matter in hand met the Parliamentary Committee of the Institution in conference, when various slight amendments were made in the Bill; and the Joint Committees decided that copies of the Bill should be sent to the Board of Trade with a request that the President should receive a joint deputation from the Association and Institution. This was done; and the Committee are now awaiting an appointment which the President has promised to give after the re-assembling of Parliament.

The Committee also took into consideration the question of promoting a Bill with reference to the rating of gas-works, which matter was also referred to them for consideration at the last annual general meeting, when it was decided that it was inadvisable at present to proceed in the matter.

A special general meeting of the Association was called to consider the Coal Mines (Eight Hours) Bill, at which there was a large attendance, and at which the following resolution was passed: "That this Association considers that any restrictions in the hours of labour in coal mines is unnecessary, and would be injurious to many industries depending on a supply of coal; and, so far as the industry of gas manufacturing is concerned, would lead to a certain increase in the price of gas—thus inflicting a hardship both on trade and domestic consumers of gas, and especially on the working classes, who at this time are largely dependent on slot-meter supplies for lighting, cooking, and heating by gas. And that we resolve to use all lawful means in opposing the said Bill; and that, further, we approach His Majesty's Secretary of State for the Home Department, asking him to receive a deputation of members of this Association, for the purpose of hearing the views of gas undertakings as to the effect of the said Bill upon the gas industry."

In accordance with the decision arrived at at that meeting, a circular, calling attention to the Bill and inviting their co-operation in the opposition thereto, was sent to all gas companies having a capital of £5000 or over, and to all local authorities owning gas-works. The result of this circular was to show that practically gas companies were united in opposition to the Bill; but the local authorities, for reasons which will be readily understood, in the main, refrained from expressing any opinion upon it.

The Committee applied to the Secretary of State for Home Affairs to receive a deputation from the Association upon the subject of the Bill, and ultimately a joint deputation comprising members of this Association, the Institution of Gas Engineers, and the British Iron Trades Association, attended before the Home Secretary on the 5th day of February last, when the views of the Association were placed before him by the late Vice-President and the Chairman of the Association. Subsequently the Committee suggested, by a circular addressed to all its members, that the shareholders in the respective companies should request their representatives in Parliament to vote in opposition to the Bill. The Committee are still watching the Bill, with a view of taking any further steps they can properly take in opposition to the Bill.

The Committee have also had under consideration the Daylight Saving Bill, upon which, however, it was not considered necessary to take any action.

The Committee's attention has been called from time to time to the unfair manner in which electric light companies and local authorities owning electrical undertakings compete with gas companies for the supply of artificial illumination; and the matter is one to which the Committee are giving close attention.

The principal matters upon which the Secretary has been consulted during the past year are the following: Application of insurance and reserve funds by gas companies. Amount to be set aside out of revenue for depreciation. Responsibility of superior tenant for gas consumed. Liability of gas company for damage caused by flaw in service-pipe. Rights of council with reference to diversion of drain on gas company's property. Supplying gas beyond limits of supply. Issue of new certificates of shares by gas company in place of lost or destroyed ones. Liability of consumer for damage by fire to hired meters, &c. Right of gas company to be paid cost of service-pipe by local authority under public lighting agreement. Liability of consumer for money stolen from prepayment meter. Right of gas company to claim for damage to mains caused by works authorized by a Provisional Order or Act of Parliament. Necessity for filing of gas companies' accounts. Manner in which non-statutory gas company should deal with income. Right of gas company to charge consumer with cost of substituting ordinary meter for slot meter. Amount of security to be given to gas company by intending consumer. Stamping of letters of allotment of new ordinary stock. Liability of late tenant for gas consumed on premises occupied by him. Rights of local authority to impose terms on non-statutory gas company asking permission to break up streets for purpose of laying mains. Right of shareholder in a gas company to act as councillor on a local authority. Right to demand list of shareholders from a gas company by a shareholder in such company.

The total number of members is now 106, of whom eight joined during the past year.

In pursuance of No. 9 of the Association's rules, the following gentlemen retire from the Committee: Mr. Thomas Berridge (Leamington Priors Gas Company), Mr. Frank Bush (South Metropolitan Gas Company), Mr. H. Hart (Canterbury Gas and Water Company), Mr. H. E. Jones (Commercial Gas Company), Mr. William King (Liverpool United Gas Company), and Mr. W. R. Phillips (Hitchin Gas Company), all of whom, with the exception of Mr. William King, offer themselves for re-election.* There is also a vacancy on the Committee consequent on the death of Mr. H. B. Chamberlain, of the British Gaslight Company.

The Secretary has received notices of intention to propose the following gentlemen as members of the Committee: Mr. Edward Allen (Liverpool United Gas Company), Mr. William Belton (Shrewsbury Gaslight Company), and Mr. Thomas May (Richmond Gas Company).

The Committee desire to record its deep regret at the death of Sir George Livesey, who was one of the founders of the Association, and was for many years its Chairman, and who, on his retirement from the chair in the year 1903, was unanimously elected its Vice-President. From the time of the foundation of the Association up to his death, the late Sir George Livesey was one of its most active and valuable members, and the Committee feel that his death is a great loss to the Association.

SIR GEORGE LIVESEY'S WORK EULOGIZED.

The CHAIRMAN, in moving the adoption of the report and accounts, said the reading of the minutes of the last annual general meeting showed how largely loomed in them the name of their late Vice-President, Sir George Livesey, and how busy he was on that occasion, acting as usual as a watchman and as a pioneer, warning them of the things they would have to confront, and fortifying them by his counsel as to how they should deal with them. The resolution they had passed very feebly expressed their feelings, if any language could express the sense of any body of men in the face of that awful power, Death. Death had deprived him personally of one who years ago had been very much at his side. As young men they were much together; and if his remarks that day showed a sort of predominating feeling at every turn, it was, he could assure them, simply because at the age to which he had himself reached—to part with a man whom one had so recently met in apparently full health and strength, a man whom one had known practically all one's life, a man whom one had a perfect admiration for, and whose career and views on the industry's special questions had had a powerful effect upon one's mind, as they always had had upon his own—the loss rested in one's thoughts rather more than it would perhaps in the thoughts of those who had known their friend for a shorter time. They had sustained, together with all the Associations with which Sir George Livesey was connected, a very great loss; and he believed he might go farther and say that the cause of labour in industrial operations everywhere had lost a powerful moral aid. Last year when they met, they had to felicitate Sir George on the great and successful part he took in helping them to get rid of the sulphur clauses, and the costly and useless requirements that had been a grievous burden on many of them. He liberated them from that, as he had previously liberated them from the domination of one of the most ill-guided unions that ever existed. If this was doubted, then let them look at the language one of the chief officers had lately been using towards the King and towards society generally, and in directing men to break the law. They could all well imagine the spirit with which Sir George contended in that most momentous battle, which thereafter established peace and subordination in their works, which up to that time had been woefully wanting.

* See report of proceedings at meeting regarding re-elections.

THE COAL MINES BILL—THE STANDARD TEST-BURNER.

The Association's career of usefulness had been evidenced by their getting the sulphur clauses removed in the case of those undertakings that joined in the promotion of the Bills initiated by the Association. Then, at the last meeting, Sir George had told them that they must keep their eyes on the Coal Mines (Eight Hours) Bill, and that they must devote themselves to getting a universal standard test for illuminating power, so that they could compare their working with that of their fellows all round. The Committee had made as much progress as they could in regard to the Coal Miners Bill. They went before Mr. Gladstone; and those who were present would never forget the calm courage with which Sir George, facing the statesman, asked him what was the real motive for the Bill and what was the excuse for it. The answer was that it had been asked for for so many years, and that it was time something was done with the matter. That was all the answer the statesman could give to the practical business man's question. Since then representatives of the Association had been attending meetings of the Shipping Federation, and had made a contribution to the expenses that were being incurred in informing the public mind regarding this mischievous measure. They were still pegging away at it at the present moment; and they were trying to get money together to further the educational progress of the movement, with the view of strengthening the House of Lords, and letting them see that the Bill had not the real sympathy of the country at large. And if the House of Lords was as independent and true as it always had been, it would take the necessary steps to put an end to the Bill altogether. Respecting the Bill for making the application of the new test-burner universal, Sir George thought they should get the co-operation of the Institution of Gas Engineers. This proved to be a longer matter than the Committee thought it would be; and they were three months before they really got shoulder to shoulder and into agreement on the question of going as a deputation to the President of the Board of Trade. The position of this question, however, was sufficiently dealt with in the report. In the report of the proceedings at the last meeting, the question of rating was also mentioned; and there, again, they had a proof of the manner in which the late pioneer was always on the look-out in the interests of the industry. He had directed the course they should follow in this matter. But in the meantime, as he himself explained at a meeting of the Special Committee, the Ipswich decision had been given; and as this confirmed the deduction from the assessment of such appliances as prepayment meters, stoves, and fittings, and was not likely to be disputed, the occasion for legislation in this direction had fallen through. The result was as it should be; and so the Committee had not had to go on with that.

THE ACCOUNTS.

The Secretary had read the accounts; and the members would have noticed the special item as to the contribution to the Coal Consumers' Defence League. It would, he thought, be, in the view of the members, a wise course if they went further in this direction; and he should take an opportunity of so urging upon his colleagues. A small item was law charges. They took the opinion of Counsel upon a special point. The opinion was not quite what they expected; and therefore he would not dwell upon it. They were, however, the better for the information, as it enabled them to put an end to doubt. They had invested £150 of their surplus; and as they had a balance of £250, he thought it would be well to invest another £150. They had at the bank £570; so that they could easily invest another £150. He was afraid he had made somewhat of a lame story; but his mind on this occasion was a little obsessed.

Alderman HART (Canterbury), in seconding the motion, said he lived some distance from London, where Sir George Livesey's work was done. At the same time that work was appreciated throughout the country. It was said an honest man was the noblest work of God. Sir George was, in every sense of the word, an honest man. That was the day of the Nelson commemoration; and Nelson's last words were: "England expects every man this day to do his duty." They knew that Sir George Livesey did his duty to the gas industry. He did his duty to the shareholders, consumers, and his workpeople. The love the workmen bore him was demonstrated by the funeral, when thousands followed his remains to the last resting-place. No better proof could there have been that Sir George had done his duty. Personally he had only been associated with him in the work of the Committee; but he had found him a man of the highest character, hard working, conscientious, and desirous of discharging the whole of his duties. They must all support every word their Chairman had said with reference to the good man whom they had lost.

The motion was carried unanimously.

ELECTION OF COMMITTEE.

The following gentlemen were retiring from the Committee on this occasion: Mr. Thomas Berridge (Leamington), Mr. Frank Bush (South Metropolitan Gas Company), Mr. H. Hart (Canterbury), Mr. H. E. Jones (Commercial Gas Company), Mr. William King (Liverpool), and Mr. W. R. Phillips (Hitchin).

It was stated in the notice convening the meeting that Mr. William King would not be offering himself for re-election.

Mr. HANBURY THOMAS suggested that Mr. King should be asked to continue as a member of the Committee. Though he had retired from official connection with the Liverpool United Gas Company, he was a Director of the Brentford Company, and was therefore eligible.

Mr. KING said, if it was the wish of the members, he would offer himself for re-election, in his capacity as Director of the Brentford Gas Company.

Mr. R. O. PATERSON (Cheltenham) thereupon moved the re-election of the six retiring members of the Committee.

Mr. W. BELTON (Shrewsbury) seconded; and the proposal was unanimously carried.

This only left one new member to elect in the place of the late Mr. Chamberlain.

Mr. PATERSON nominated, seconded by Mr. BERRIDGE, Mr. Belton, of Shrewsbury. Mr. BOTLEY nominated, seconded by Mr. BROADBERRY, Mr. Thomas May, of Richmond. Mr. CLARRY nominated, seconded by Mr. SHOUBRIDGE, Mr. Allen, of Liverpool.

Both Mr. Belton and Mr. May withdrew their names in favour of Mr. Allen, who was thereupon unanimously elected.

SUGGESTIONS.

Mr. T. MAY (Richmond) suggested the advisability of the Committee finding out from the Companies connected with the Association what friends they had in Parliament, so that at any time they might be approached to help along the work the Committee were carrying out. He had no doubt there were many Members of Parliament who were shareholders in the Companies, and it might be helpful if they had a list of the names of such gentlemen.

The CHAIRMAN regarded the suggestion as a very useful one, and promised that it should have the consideration of the Committee. Mr. May would probably hear further from the Secretary on the point.

Mr. ARTHUR VALON (London) inquired whether the Committee could do anything to get the Board of Trade returns expedited. The Committee would be aware of the difficulty and trouble that occurred in parliamentary and other work owing to the returns being something like two or three years behind. If the Committee could do something (say) by representation to the Board of Trade or in any other way, and secure an alteration, it would confer a large amount of benefit.

The SECRETARY thought a letter might be written to their President, Sir Henry Kimber, M.P., asking him to put a question on the matter in the House to the President of the Board of Trade.

Alderman HART inquired if anything further had been done to obtain votes for gas companies and other joint-stock companies as owners of property.

The SECRETARY pointed out that there was a Bill in draft. He did not know whether it had yet been promoted; but he knew that it would not receive the support of the Government.

The CHAIRMAN observed that the measure had been promoted by the Directors' Association.

VOTE OF THANKS.

Mr. WILLIAM KING moved a hearty vote of thanks to the Chairman and the Committee for the attention they had paid to the affairs of the members during the past year. They one and all associated themselves with the references of the Chairman to their late and much lamented friend.

The CHAIRMAN, acknowledged the vote, and remarked that it would be necessary for each one to do his best in the future. They had had a considerable loss; and they would want in future in their work all the cohesion, loyalty, and vigilance possible.

The proceedings then terminated.

SOUTH METROPOLITAN COMPANY'S RATING APPEALS.

Objections to the Woolwich Union's Accounts.

At the Woolwich Workhouse, on Monday last week, Mr. H. D. Gordon, one of the Auditors of the Local Government Board, held a special sitting to continue his hearing of objections raised by the South Metropolitan Gas Company to the passing of the accounts of the Woolwich Union for the year 1907-8. Mr. L. M. S. Pasmore, of Messrs. Hicklin, Washington, and Pasmore (the Company's Solicitors), accompanied by Mr. F. M'Leod, the Secretary, appeared for the objectors; Mr. Tom Cutter, the Clerk to the Woolwich Assessment Committee, represented the Union.

In 1904, Messrs. Dinwiddy and Sons were appointed by the Woolwich Union and other authorities to value the special properties in their Unions for the forthcoming quinquennial revaluation. In due course, the South Metropolitan Gas Company appealed against the proposed assessment of their property in Woolwich, Greenwich, Bermondsey, and Lewisham, and the dispute was carried as far as the Court of Appeal. But the Company failed to sustain their objections to the valuations. When Messrs. Dinwiddy's bills of costs for each Union were delivered to the Company, the largest, which was in respect of the Woolwich Union—amounting to £997 18s.—was reduced by the Taxing Master to £151. Finding subsequently that the Union had paid Messrs. Dinwiddy's bill in full by handing the firm the amount taxed off by the Taxing Master, the Company, as one of the largest ratepayers in the Union, objected to the passing of the accounts by the Local Government Board Auditor, on the ground that some of the payments to Messrs. Dinwiddy were unreasonable and excessive.

The case for the Union, as set forth by Mr. Cutter, was that Messrs. Dinwiddy were appointed to value certain property in its area at 15s. per cent., and other property (including gas-works) at 25s. per cent.; these charges to be based on the amount of the assessment as settled by the Assessment Committee in 1905. Beyond this, the valuers were to be paid, where cases went to appeal, £5 5s. per day for attendance in Court or with Solicitors, or where their services might be requisitioned in connection with an appeal. These charges, and only those fairly made under their contract, had been allowed to Messrs. Dinwiddy.

Mr. Pasmore's contention was that the Taxing Master, by his action, had declared that the charges were excessive. Messrs. Dinwiddy not only received their 15s. and 25s. per cent. on the valuations, but, though the appeal of the Gas Company lasted only seven days, charged 136 days at £5 5s. They also charged 47 days at 15s. for the services of their clerks, which clearly was part of their commission contract work. No less than £69 10s. was charged for letters; 278 of them (many of a purely circular character) being priced at 5s. each. For attendances to discuss matters of policy, &c., £72 9s. was charged; ten consultations at £3 3s.; and other items, a great many of which were for work within the bounds of their commission contract. With regard to the large amounts charged at £5 5s. per day in connection with the appeals, this sum was allowed for Mr. Dinwiddy's whole time. But there were four appeals in which he was engaged; and as, by agreement, one was taken as a test case, and he had charged each Union

£5 5s. per day, it was evident that each one could not be having his whole and undivided attention.

The Auditor remarked that some very important points had been raised which he should not decide in a hurry, but consider in Chambers. It was, however, pretty evident that the Union had power to combine with others in these matters to save expense, and had not chosen to do so. He should reserve judgment, and before giving his decision would make a close examination of the books.

THE GAS INDUSTRY IN ITALY.

Some interesting statistics with regard to the gas industry in Italy are given in a British consular report just issued. The gas-meters in use are nearly all of Italian manufacture, and only a small number are imported by some gas companies who have their headquarters in other countries, and receive there the meters they require. According to the official returns, the meters that were officially tested in Italy during 1906 numbered 77,078, of which 34,013 were new and 43,065 were examined because they had been either repaired or transferred. The employment of acetylene for lighting is limited in Lombardy; and it appears that there are only seven communes where it is used. It is supplied by five firms; being municipalized at Pontisul-Mincio, Roverbella. In the consumption of gas at Milan, a remarkable increase has taken place, as is shown by the following figures. In 1887 there were only two gas-works in the city, with a daily output of 16,849,800 cubic metres (about 595 million cubic feet) of gas, of which 12,772,000 cubic metres (about 451 million cubic feet) were for private use. In the production of this gas, 56,940 tons of coal were consumed. In 1907, the production had increased to 64,670,540 cubic metres (2283½ million cubic feet), of which 55,252,700 cubic metres (about 1951 million cubic feet) were for private use; and the coal consumed amounted to 213,638 tons. A comparison between the number of consumers and the number of inhabitants shows that in 1886-7 there were 20,000 consumers out of 350,000 inhabitants, or 1 out of every 17; and in the year under review there were 110,232 consumers out of 560,000 inhabitants, or 1 in 5. This increased consumption, of course, necessitated additional plant; and the Union des Gaz raised the output of their three works to 298,000 cubic metres (10½ million cubic feet) per day. Moreover, large works have lately been constructed at Bovisa, near Milan, which have an ordinary production of 60,000 cubic metres (2,118,000 cubic feet), which can be increased to 500,000 cubic metres (17,650,000 cubic feet). One of the gasholders there has a capacity of 80,000 cubic metres (2,824,000 cubic feet), and is the largest in Italy.

DANISH GAS COMPANY.

The Annual Report and Accounts.

The accounts for the year ending the 30th of June last, which will be presented at the annual meeting of the Danish Gas Company next Friday, show that the net revenue was £66,191. Adding to this the amount brought forward, the total standing to the credit of the profit and loss account is £102,820. In their report, the Directors explain that, compared with the previous year, there was an increase of nearly 8 per cent. in the quantity of gas sold; but the revenue shows a falling off to the extent of £972, owing to increased expenditure in connection with the plant and to higher wages being paid to the workmen. The recent high price of coal occasioned a large additional charge to the revenue account; but this was partly met by better prices realized for coke and by the enhanced price received for gas under the sliding-scale.

After charging the debenture interest and loss on exchange, and setting aside £11,000 to the reserve and redemption account (the old reserve and depreciation accounts having been amalgamated under this title), there remains £80,409 available for distribution. An interim dividend of 2½ per cent. on the preference shares and 4 per cent. on the ordinary shares was paid on the 25th of March; and the Directors recommend a dividend of 2½ per cent. on the preference shares, 1¼ per cent. on the £20,000 new issue of these shares, and 5 per cent., together with a bonus of 1 per cent., on the ordinary shares. These dividends and the bonus will amount to £42,750, and will leave a balance of £37,659 to be carried forward.

The capital account shows an expenditure during the year of £40,264 for additional land, buildings, apparatus, mains, meters, &c. Of this sum, £22,235 was laid out in connection with the new works at Flensburg, the gas and water supply in the Tikjob district, where the supply to consumers was commenced in July last, and the new building at Frederiksberg, which has been erected for the purpose of providing central offices, show-room, &c., for this district, and offices for the Company's chief officers in Denmark. This additional expenditure has been met in part by the issue, in June last, of 2000 £10 preference shares at par. Further funds have also been provided by loans from the Company's bankers in London. To pay off these, and to meet the expenditure on new works and extensions in the near future, the Directors propose to raise further capital; and they will submit for the consideration of the shareholders a resolution authorizing them to do so.

Accompanying the Directors' report is that of the Engineer (Mr. A. W. Edwards). He states that the total consumption of gas in the twelve months ending the 30th of June was 1,098,767,000 cubic feet; being an increase of 80,730,000 cubic feet, or 7·93 per cent., on that of the preceding year. Since his previous report, the building of the new works at Flensburg has been commenced. On the old works it has been necessary, on account of the great increase in the consumption of gas, to build two new settings of retorts, and thus raise the productive capacity. The increase in the consumption of gas at the Aalborg station has been very great; and the extension of the works is under consideration. At Viborg a new retort-house has been erected, and the ovens are being built. The erection of a new holder at Randers has been decided upon; and the work is to be commenced at once. The influence of the new electricity works has slackened off, and there has been an increase in the consumption of gas. This has also taken place at Assens; and the extension of the carbonizing plant and the building of an additional gasholder are under consideration. As the works at Elsinor are supplying gas to the Tikjob district, where the consumption is larger than was anticipated, their extension is in contemplation. The water-works there are finished, and the supply of water has been commenced. Mr. Edwards adds that all the necessary repairs have been either carried out or are in progress, and that the stations will be in good working order for the ensuing winter.

GAS AT THE BREWERS' EXHIBITION.

Though the exhibition of machinery, appliances, and produce used by brewers, licensed victuallers, and others, which is held annually in October at the Agricultural Hall, Islington, is one of the most popular of the series of shows associated with the place, and a considerable number of the visitors are necessarily, from the nature of their business, large consumers of gas, there were only four stands, in the exhibition which closed last Friday, which call for notice in our columns. Taking first the department of lighting, an excellent show was made, at their stand in the arcade, by the London Lamp-Works, of Dyer's Buildings, Holborn, of their "Reflex" burners, which are adapted to the lighting of dining, club, and billiard rooms. These burners, which have an aluminium top, are made in two sizes—the larger consuming 3½ cubic feet and the smaller 2 cubic feet of gas per hour, and having, it is claimed, a lighting capacity of 30 candles per cubic foot. The stand was furnished with a table covered with green cloth, to represent a billiard table, and over it was a suitable pendant. The burners used for this kind of lighting are fitted with a special silica chimney, which is very strong and impervious to heat. It is stated that the expense of lighting a billiard-table for 1000 hours with a three-light pendant, with gas at 3s. per 1000 cubic feet, is only £1 13s., whereas the cost of electricity, using 1½-watt lamps, giving half the amount of light, at 4d. per unit, would be £4—showing a saving of £2 7s. There was a good assortment of lamps and brackets at the stand. A brilliant display was made, in their usual position in the hall, by the Richmond Gas Stove and Meter Company, Limited, whose stand was lighted by Messrs. W. Sugg and Co.'s high-pressure "Belgravia" lamps, so arranged as to show off the goods to the best advantage. These comprised cookers suitable for hotels, special grillers, hot closets, carving-tables, and all restaurant requirements. In addition, there was a varied assortment of gas-fires, gas-steam radiators, and stoves. Close by, the Eagle Range and Gas-Stove Company, Limited, showed in operation their "Premier" and new "Eagle" ranges and their "Premier Eagle" fire-grate; also a speciality in the shape of the new "Eagle" governor grate. The only stand remaining to be noticed is that of Messrs. S. Clark and Co., who, as usual, had a good show of their patent "Syphon" bar stoves, gas heating-stoves for use without a flue, counter mullers, urns, &c. The firm have been regular exhibitors for some years; their stoves being specially suitable for licensed victuallers' use.

CHARGE FOR WATER IN THE CITY OF LONDON.

Explanation by the Chairman of the Metropolitan Water Board.

At the Meeting of the Metropolitan Water Board last Friday—Mr. E. B. BARNARD, M.P. (the Chairman), presiding—the subject of the Board's increased charges for water in the City, and the agitation which has ensued thereon, was dealt with by him, in accordance with an intimation which had been given to this effect.

The CHAIRMAN commenced by explaining that, in view of the fact that a meeting of protest against the Board's charges was to be held at the Mansion House next Thursday, the Chairmen of the Standing Committees of the Board, in consultation, had come to the conclusion that it would be desirable that he (the Chairman) should make a statement concerning its position, which, he believed, was largely misunderstood. The unpopularity of the Board might be said to be a legacy from the Water Companies, who had been for years the most unpopular bodies possessed of the monopoly of a public service. The main features of the Board's unpopularity were: (1) Objection to municipal ownership; (2) jealousy of the particular body in which Parliament had seen fit to vest the great undertaking; (3) accusations of extravagance in administration; and (4) hostility created by the changes that had recently been made in the scale of charges. The unpopularity with which the Board found itself faced was the result of misunderstanding. When the Metropolis Water Act of 1902 brought the Board into existence, the Water Companies had for years been preparing for the fight; and the result of the arbitration, out of which he ventured to think the Board had come with considerable *éclat*, was that the price of the undertakings, together with debentures and mortgage loans, represented in all a total capital debt of £47,000,000, which meant a dead-load of nearly £1,500,000 in interest. As to the accusations of extravagance, it had to be remembered that the Board had been compelled to purchase the undertakings of the eight Water Companies at a price which merely left it possible, with the normal increase of business, to secure a margin of revenue over expenditure; while it was certain that if the Companies had gone on they could not have expected to maintain the high-water mark of their prosperity. As soon as the Board came into existence, it was faced with the necessity for incurring expenditure which the Companies had postponed; they having, in anticipation of purchase, restricted their capital expenditure to a minimum in order to cope with the requirements only of the immediate future. On the other hand, the Board, as well as paying the full market price for the undertakings, had to meet all the larger demands that had been accumulating, and rise to the higher standard expected from municipal control. But the cost of production under the Board compared

favourably with that of the Companies. During the last three years, the expenditure of the Works and Stores Committee averaged 22·67 per cent. of the income, while the similar expenditure of the Companies during the last three years of their administration averaged 22·72 per cent. The Companies' expenditure on works in 1901 2 was £601,000, compared with £630,000 expended by the Board in 1906-7. But the percentage of expenditure to income in 1901-2 was 24·041, whereas under the Board in 1906-7 it was only 22·84. Putting the matter in another way, the expenditure per 100 services in 1901-2 was £64 9s., whereas under the Board in 1906-7 it was only £59 8s. Further, charges which were placed to capital account by the Companies had to be met by the Board out of current revenue. This was sound finance; and the City should be the first to appreciate it. Then, by the mere operation of compulsory purchase, the paid-up capital of the Companies —£22,749,497 – had increased in the hands of the Board to £47,547,707. Looking at the matter in another light, the public were now having their supplies placed practically beyond the reach of drought, and they were getting purer water. It had been alleged that the Board had been extravagant in the matter of staff; but while the amount of salaries paid by the Companies was upwards of £157,000, exclusive of emoluments, those paid by the Board only came to £152,000, while the staff had had to be augmented owing to the increased amount of clerical work involved by municipal administration, and the Board had its own legal staff instead of employing outside solicitors. The expenditure on rates and taxes had increased by nearly £60,000; and the loss from empty properties was greater now than it was in the time of the Companies. The real reason underlying the proposed meeting at the Mansion House was the hostility which had been occasioned by the changes which had taken place in the revenue-raising methods of the Board. But in this matter the Board had been the mere creature of Parliament. They were told that they must bring in a Bill which would deal with the equalization of charges for water all over London. It was not their own choice or their wish; it was a direct obligation imposed upon them by Parliament. They were obliged to bring in the Bill last year, because that was the date fixed by Parliament. The Board acted openly in the matter; they did nothing in secret. They were not interested parties; they had nothing to gain or lose except public esteem. It was unfair, in discussing this question, to overlook the fact that their Charges Act was the outcome of a great parliamentary inquiry by a Committee of both Houses, at which the interests concerned were represented. In that Act the Board had striven for a maximum of uniformity and equality, coupled with the virtue of adversely affecting a minimum of consumers. As many as four different scales of charges were placed by the Board before Parliament; but the 5 per cent. inclusive rate for domestic supply, while it affected adversely 226,000 consumers, benefited 469,000, and left 271,000 unaffected. They were now hearing a great deal from the 226,000, and hardly anything from the 469,000 consumers. Generally speaking, the East London, Kent, Lambeth, and Southwark and Vauxhall consumers benefited, owing to the fact that the prevailing rate in those districts was, as a rule, above that charged by the Board. Owing to amendments made in the Board's Charges Bill, their estimated income had been considerably reduced. With regard to the grievances which it was proposed to discuss at the Mansion House meeting, the Board had recognized that the uniform charge of 5 per cent. would be excessive in the case of highly-rated business premises in the City and adjacent districts, where the use of water was limited. The New River Company, in such cases, granted a voluntary rebate of 30 per cent. in the case of such premises exceeding £300 annual value. The Board proposed to retain in their hands the discretion which the Companies exercised, of differentiating within the maximum charges, according to the particular circumstances of like cases. But the Corporation asked for a special clause, making it compulsory upon the Board to charge for water in the City in the way the New River Company had charged for it—indeed, they went further, and asked that it should be compulsory upon the Board to supply by meter. This would have meant that thousands of domestic conveniences would have been allowed to fall into a filthy state. The Joint Committee of both Houses of Parliament refused to allow the Board any discretion in the matter; insisting that the 5 per cent. rate should be applied uniformly, but allowing a rebate of 20 per cent., or not over 30 per cent., on all premises exceeding £300 rateable value, and not charged with inhabited house duty, throughout the Board's area. The Board had to comply with the provisions of the Act. They were bound to charge at the full rate of 5 per cent. throughout the area, in order to secure the revenue necessary to meet their obligations and carry on the undertaking. The issue the City had to contemplate was this: The Water Board had to get the money necessary for their purposes; and the question of a rate-in-aid or a municipal rate naturally arose. He therefore thought it very unfortunate that in the present circumstances, the Board being unable to tell until the end of the financial year how the Charges Act would work, such an agitation as that going on in the City should be conducted under such distinguished patronage.

In the course of the discussion which followed, Mr. Fitzroy Doll remarked that the Chairman's statement would be no answer to the "man in the street." He asked why the Board should be threatened with bankruptcy after raising nearly every one's water-rate, when the Water Companies could make handsome profits of 8, 10, or 12 per cent. while paying large sums to Directors. Sir Melvill Beachcroft said he doubted whether the members of the Board were really able to answer the criticisms levelled against them out of doors. He also mentioned that in the last six months £116,000 less had been received in water-rentals than in the corresponding period of last year, and that the Board's estimated expenditure for 1908-9 exceeded the expenditure of 1907-8 by more than £24,000. The financial position was such that they should do something in the near future to bring in their income. Mr. Kenneth Foster asked if the Board could not deal with large buildings like the Bank of England and the Stock Exchange under section 24 of the Act. He said the Bank of England was rated at £60,000 a year, which, at 5 per cent., gave a rateable value of £3000 for the purposes of the Board. He thought that anybody who found himself in the same circumstances would try to sink wells, as the Bank was doing. Could not the Board get the Act amended, so that they might be in a position to deal more equitably with these large concerns? Mr. C. G. Musgrave (the Chairman of the Appeal and Assessment Committee) said the Board could not make agreements under section 24 with large consumers except for special reasons. Up to the present there had been no special reason shown why they should depart from that which was laid down by Parliament with full knowledge of what the effect would be. Where the Act allowed any discretion (which was in very few cases indeed), the Committee were doing everything they possibly could to deal impartially with all sections of the community.

PLYMOUTH CORPORATION WATER SUPPLY.

Annual Report of the Engineer.

The Plymouth Corporation Water Committee at their meeting last Friday had before them the annual report of the Water Engineer (Mr. F. Howarth). He stated therein that, notwithstanding the precautions taken to ensure the water being sent from the Burrator storage reservoir in as clean and pure condition as possible, by removal of vegetation round the margin and of weeds growing in the reservoir, there had accumulated an amount of growth and deposit in the 25-inch trunk main sufficient to materially reduce its carrying capacity. The average rainfall on the gathering-ground for the year ended Dec. 31, 1907, was 58·77 inches, or 12 per cent. in excess of the average annual fall for the previous fifteen years. As the greater part of the fall occurred in the summer, the storage was very little drawn upon. In January last, the work of laying the new trunk main between the Roborough and Crown Hill reservoirs was begun, and up to the 31st of March £4983 had been expended upon it. (This work has since been completed.) The extensions of mains during the year amounted to a total of 2 miles 597 yards; making the length now in use 132 miles, of which 66 miles had been added since 1890. On the above-named date the estimated number of supplies existing was 18,642 within the borough and 1922 outside—a total of 20,664. The consumption for all purposes averaged 36·31 gallons per day per head of the population, against 36·61 gallons in 1907. Mr. Howarth remarks that the question of waste is very important; and he thinks the Committee will be well advised in taking strong measures to keep it as low as possible. The total income for the year was £32,231. The charges for maintenance and management amounted to £9857; and the payments on account of interest, sinking fund, and income-tax came to £17,543—leaving a net profit of £4830. Compared with 1906-7, the total income increased by £220. Maintenance and management charges were greater by £147; while capital charges showed a decrease of £36—the net profit being £110 more than in the preceding year. On capital account, the total expenditure to the 31st of March last was £372,501; while the amount repaid or in the redemption fund was £103,518.

MABLETHORPE WATER SUPPLY.

Proposal from the North-East Lincolnshire Water Company.

At the Meeting of the Mablethorpe Urban District Council last Tuesday, application was made, on behalf of the North-East Lincolnshire Water Company, for consideration by the Council of a proposal that the Company should lay mains in the public roads in the parish for the purpose of providing a supply of water. It was stated that a Company had been formed and were supplying several neighbouring districts. They undertook to reinstate the roads to the satisfaction of the Council's and the County Surveyors, and to maintain for twelve months the portions opened. If permission were granted, the mains would be laid this winter, and would provide a considerable amount of local employment. Water would be supplied free for fire extinction, and the necessary hydrants fixed gratis. The charges for water for domestic purposes would be those fixed by Parliament. It was urged that such a supply of water as that suggested would be an immense benefit to Mablethorpe, and that, while the promoters of the scheme would become ratepayers, the Council would not be involved in any expense. The Clerk (Mr. F. C. Chard) reminded the Council that two years ago the same matter was before them, when Mablethorpe was included in the Bill promoted by the Company. The Council petitioned against the Bill, with the result that Mablethorpe was struck out. Mr. Butcher, a representative of the Company, attended the meeting; and from his statements it was gathered that the Company intended boring through the chalk to the greensand. They were going to try borings at Sutton-on-Sea; and if they could not get a suitable supply of water there or at Mablethorpe, they would bring it from their recently constructed works at Alford, where there was abundance. If the Council decided to have the water, the work would be commenced as soon as possible, and the supply would be available not later than next July. The Clerk pointed out that the Company could not get to Mablethorpe without the consent of the Louth Rural District Council to come through Trusthorpe. It was ultimately decided to call a special meeting of the Council to further consider the subject.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A most excellent opening indeed has been made of the session by the Western District of the Scottish Junior Gas Association. There was a very gratifying attendance of members at the meeting to-night—said to be the largest which has been experienced at any of the meetings of the Association hitherto held. The address of the President—Mr. A. H. Whitelaw, of Provan—could not be listened to without feeling that its preparation must have entailed a great amount of labour. The President's remarks were largely based upon the chemical side of gas production. They were not by any means laboratory results, nor were they confined to his own experience; for carburetted water gas is not made in the Corporation gas-works of Glasgow. The figures he quoted were derived from wider fields than come under his own daily

purview, and are thus tokens of an extensive range of reading. In the matter of carburetted water gas, his conclusions were very convincing as to what it is possible to do with it and what must not be expected of it. To controvert his conclusions would require a lot of thinking. Equally convincing were his thoughts upon the thermal efficiency of various forms of power, and the character and capabilities of producer gas. In all the subjects he dealt with there was a satisfying feeling of "at-homeness" which gave to the address a sense of completeness that was most gratifying to the listeners. In accordance with the practice of the Western District, discussion was invited upon the President's address; and the discussion which ensued was so distinctly above the average that the practice is to be commended. It is only natural that a production by one of the leading members of the Association—as the President always is—should contain matter worthy of comment. In this connection, it is to be noted that in Mr. M'Laren, of Dumbarton, the Association have gained a decided acquisition to their speaking power. The medal for the best paper read in the course of last session has been awarded to Mr. T. H. Whitehead, who is an employee of Messrs. Brotherton and Co., the lessees of the chemical works at Provan, for his instructive communication on pumps. There is good reason to expect very vigorous work on the part of the Association this winter; a most excellent syllabus having been drawn up.

The minutes of the Gas Committee of the Greenock Corporation, which came before the Corporation on Tuesday, contained the letter of resignation of Mr. W. Ewing, the Engineer and Manager, which was in the following terms: "I regret to say that, in view of the prolonged friction which has existed in connection with the management of the gas-works, and the failure of the Committee to carry out the suggestions which I have made from time to time, I have resolved, for my own personal reputation, to put an end to a state of matters which, in my opinion, has been highly detrimental to the gas consumers in the burgh, by tendering, as I now do, my resignation, under reservation of all claims competent to me for services rendered to the Corporation. My resignation will take effect on the expiry of three months from this date (Sept. 9). As I have already pointed out, notwithstanding the deficiency on last year's revenue account, which has led to the appointment of a Special Committee, the working costs of the Gas Department show a net saving for last year, when compared with the year 1900-1, of no less than £18,754; and this increased efficiency has resulted in a reduction in the price of gas to the extent of 8d. per 1000 feet, and free stair lighting for three months in the summer, equivalent to a gross reduction to gas consumers of £11,000 per annum. I should have preferred, before taking this step, that the Committee should, as requested, have formulated and furnished to me their objections, if any, to the management of the works; but as they have refused to do this, I have resolved to send in my resignation, and leave the gas consumers to judge who is to blame for the present state of matters. So far as I am concerned, I have faithfully and honestly served the Corporation; but I cannot say I have had the support which I was entitled to expect from my Convener and Committee, especially since the position I took up in connection with the stoking machinery, which has turned out, as I predicted, to be a serious loss to the department." The letter was not referred to at the meeting of the Corporation. Mr. Forbes, the Convener, having moved the approval of the minutes of the Committee, Mr. Mitchell called attention to the official test by the new photometer, and said that although the apparatus registered 24-candle power they would have to discount this by at least 25 per cent. Bailie Shearer regretted that the Corporation should have got this new apparatus. If they were bewildered before, they were more bewildered now.

The Corporation of Greenock do not seem to be very willing to face the situation that has been created by Mr. Ewing's resignation, as is shown by their avoidance of reply to his criticisms of their actions; but this is the time of the year when the municipal elections are in progress, and the councillors are obliged to say something to the ratepayers regarding their management of burgh affairs. In this way we have Bailie Williamson, on Tuesday evening, informing a meeting of the electors that it was only due to them that he, as a member of the Gas Committee, should give them at least his own views as to the position of affairs. He could assure them that there was nothing sensational to disclose, and no mystery. It was quite possible that the Gas Committee, in presenting accounts showing a deficit of £2755, and in requiring to increase the gas rate by 2d. per 1000 cubic feet, were in an exceptional position compared with other large towns; but while this might be so, it had to be borne in mind that the Gas Committee a year ago were also in an exceptional position. It would be remembered that at that date, notwithstanding the high price being paid for coal, Greenock was one of the few towns that did not increase the price of gas, and that in opposition to the desire of the Convener, who moved that the price should be raised. The first question, he went on to say, which one naturally asked in connection with the deficiency was where the loss had occurred; and on looking over the accounts, and comparing them with the estimates made at the beginning of the year, it was at once apparent that the following items had exceeded the estimates: Coal, £732; benzol, £151; repairs to gas-stoves, £117; rates and taxes, £224; expenses of gas exhibition, for which no allowance was made, £106; wages of stoker, £62; cartage and water, £106; and commission on loan, £52. Under the heading of meters, mains, and service-pipes, the estimate had been exceeded by £1077. These sums amounted in all to £2626; and if they added the deficiency estimated at the beginning of the year—£92—they had a total of £2718, which was practically the amount of the deficiency. The two items which, to his mind, required explanation were those for coal and meters. So far as the coal account was concerned, they would naturally suppose that if £700 worth more had been used, the quantity of gas would have been all the greater; but this was not so. The only other conclusion one was forced to was that the quality of the coal supplied must have been inferior. This view, however, the Manager did not agree with; and the matter in the meantime rested there. With regard to the item of £1077 for meters, mains, and service-pipes, that was, to a large extent, explained by the fact that during the year a great number of old meters were broken up and sold as scrap, and had to be written off. In addition to this, however, there was an exceptional demand for the prepayment meters, fully 600 of which were for new consumers. This was a feature that no one could very well foresee, and which no one regretted, as they would undoubtedly benefit in the future by the increased consumption of gas. The expenditure might quite well have been charged to capital, and reduced the loss; but in the past it had been the custom of the department to charge meters to revenue. A good deal had been said about the resignation of the Manager. It seemed to him, in fairness to the Manager and also to the Committee, that some definite statement should be made. When the financial statement for the year was submitted to the Gas Committee, considerable dissatisfaction was expressed; and it was agreed to remit the whole matter to a Sub-Committee, of which he (Bailie Williamson) was a member, to confer with the Manager and report. As the result of this conference, at which not only the finances but the whole management was fully gone into, the Manager tendered his resignation. This was exactly what took place; and it appeared to him that there was no reason why the ratepayers should not know these facts. Referring to these remarks by Bailie Williamson, a local newspaper, in an editorial article, made the statement that "they do know, and did know, these facts. It is what they don't know, and what, perhaps, they should not suspect, which exercises their minds."

Messrs. W. & C. Fairweather, the Joint Managers of the Kilmarnock Corporation gas undertaking, reported to the Town Council the other day that last year £2252 was spent upon 1000 public lamps, bringing out the price per lamp at 45s., which included all costs and charges. In the estimates for 1908-9, there is provided a total sum of £1800, which, in the same number of lamps, brings out the average cost per lamp per annum, inclusive of all charges, at 36s. In that estimate the account for gas is less by £370. The amount of gas consumed last year in public lamps was 10,470,000 cubic feet, which, at 2s. 8½d. per 1000, worked out at almost £1420. In the estimate for this year, the amount to be spent upon gas for public lighting is £1050, which comes out at about 7,750,000 cubic feet. The Gas Committee unanimously recommended that the public lighting of the town should be centralized and put into their hands, they to supply gas, maintain lanterns and fittings, and light, extinguish, and clean the lamps, for the sum of 32s. 6d. per annum. Mr. R. Muir, the Convener of the Gas Committee, said he thought the Committee had been exceedingly generous. This was the first time they had given preferential treatment to anyone; and he had no doubt that the new arrangement would work better than the old one. The Council adopted the recommendation.

At a meeting of electors in Falkirk on Thursday evening, Mr. Stevenson, one of the candidates, dealing with the banquet at the opening of the gas-works (in May, 1906), said that his attempt to give them information regarding it had been frustrated, in respect that Mr. Neilson, immediately he saw the bill calling that meeting, drove hurriedly to the gas-works, and, finding that the Gas Manager was absent, took away the letter-book; so that he was not able to get the information he wanted. On the same evening, a special meeting of the Gas Committee was held to consider the matter. The report of what took place at that meeting, evidently furnished, states that "at the beginning of the week it came to the knowledge of Dean of Guild Neilson that a circular was being issued by some person unknown, containing a copy of a letter written asking subscriptions in connection with the banquet at the opening of the gas-works, with a further addition of a statement of the expenditure in connection with the banquet. In the letter asking for subscriptions, allocations were made of the sums approximately expected from each of the contractors, as some of the contractors desired that the function should be a large one, and many gas managers and engineers invited, for the purpose of advertising their machinery, &c. The allocations, when added up, came to about £260, and the expenses in connection with the banquet came to £131. The obvious insinuation of the circular was that Dean of Guild Neilson had pocketed the difference. Mr. Neilson, who had been appointed by the Gas Committee to carry through the arrangements in connection with the banquet, owing to the illness of the late Mr. M'Crae, the Gas Manager, had given instructions about the writing of these letters, although none of them were seen by him after giving the instructions; they being signed by the then Assistant-Manager. Mr. Neilson made inquiries, both at the gas-works and at the burgh buildings, and finding everything in order, called on Wednesday morning at the gas-works to see the Manager and get two letter-books, where the correspondence appeared, so as to enable him to take immediate action to discover the distributor of the circulars. When Mr. Neilson called, the Manager was absent, but the senior clerk was seen, and he gave Mr. Neilson the two letter-books, which were handed over to his law agent. On the following morning, Mr. Neilson, to keep the clerk and himself right, telephoned to the Gas Manager, advising him that he had got the letter-books. While Mr. Wilson, at the telephone, demurred to his retaining them, nothing definite was done until, in the forenoon, a letter was written by the Gas Manager, giving Mr. Neilson an hour in which to return the books; and these he returned at once. The matter had come to the knowledge of the Gas Convener (Bailie Bogle), and he forthwith called an emergency meeting of the Gas Committee." At the meeting of the Committee it was pointed out that Mr. Neilson was being libelled in connection with services rendered to the Gas Committee at their request. Some of the members thought that Mr. Neilson was therefore quite entitled to have everything placed at his disposal which would enable him to take speedy action. After discussion, the matter was passed over.

Damage to Gas-Lamps by Vehicles.—The Lighting Committee of the Marylebone Borough Council report that since the 1st of January 342 public lamps have been damaged in the borough by motor and other vehicles.

Steam-Rollers and Gas-Mains.—The Secretary of the Wandsworth and Putney Gas Company (Mr. C. W. Braine) has just written to the Wandsworth Borough Council complaining of their steam-roller being brought over the recently laid main in Fairfield Street, adjacent to the Company's works. He pointed out that upon these mains the gas supply of the district depended, and that the Council must be held responsible for any damage caused by the roller. It was decided to inform the Company that the Council cannot accept any responsibility in the matter, and that the gas-mains should be laid at a sufficient depth to be safe.

CURRENT SALES OF GAS PRODUCTS.

Sulphate of Ammonia. LIVERPOOL, *Oct.* 24.

There has been a continued good demand during the week, but, production having now become more abundant, the supplies proved ample to meet all requirements. Consequently, although in some instances full prices have been realized, the market is rather quieter at the close, and values remain unchanged at £11 5s. per ton f.o.b. Hull, £11 6s. 3d. to £11 7s. 6d. per ton f.o.b. Liverpool, and £11 8s. 9d. per ton f.o.b. Leith. In forward delivery, makers have not changed their attitude in regard to prices for delivery over next year; but meantime offers are being made abroad at a comparatively small premium on spot prices. For delivery up to the end of the year, values remain about £11 8s. 9d. to £11 10s. per ton f.o.b. at the principal ports.

Nitrate of Soda.

This article is quite unchanged at 9s. 6d. and 9s. 7½d. for ordinary and refined qualities respectively.

Tar Products. LONDON, *Oct.* 26.

There has been little change in the markets with tar products during the past week. Pitch maintains its position, but has not advanced farther. Makers, however, are very firm in their ideas for either prompt or forward delivery. Creosote is steady, and inferior qualities are reported to have been sold in London at 2⅝d.; but the majority of manufacturers will not accept anything under 2¾d. In the Midlands, 2¾d. has been accepted to the end of the year; and it is stated that a shade under this figure has also been taken. In Yorkshire, oil has been offered at 2⅝d. all over next year without success. Benzol is quiet, and sellers are still willing to accept low figures for delivery to the end of next year. Toluol is steady, and good business is reported for delivery to the end of June. Solvent naphtha is firm, and makers decline to quote just now. Carbolic is quiet, and business has been done on the east coast for prompt delivery at 1s. 1½d. Refined naphthalene is depressed, and sales are difficult to negotiate. Salts are fairly well maintained owing to the firmness of creosote.

The average values during the week were: Tar, 12s. 9d. to 16s. 9d. *ex* works. Pitch, London, 23s. to 23s. 6d.; east coast, 22s. 6d. to 23s.; west coast, 22s. to 23s. f.a.s. Benzol, 90 per cent., casks included, North, 6¼d. to 6⅜d.; London, 7d. to 7¼d.; 50-90 per cent., casks included, North, 6¼d. to 6⅜d.; London, 7d. to 7¼d. Toluol, casks included, London, 8⅝d. to 9d.; North, 8½d. to 8⅝d. Crude naphtha, in bulk, North, 3¼d. to 3½d.; London, 3½d. to 3⅝d.; solvent naphtha, casks included, North, 10d.; London, 11d.; heavy naphtha, casks included, North, 10d.; London, 11d. Creosote, in bulk, London, 2¾d. to 2⅞d.; North, 2⅝d. to 2¾d. Heavy oils, in bulk, 3d. to 3 1/16d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d. to 1s. 2d.; west coast, 1s. 1d. to 1s. 1½d. Naphthalene, £3 10s. to £6 10s.; salts, 32s. 6d. to 35s., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been firm throughout the past week, though without any decided advance in price. The principal Gas Companies still maintain their quotation for delivery to the end of the year, and also for January-April. Ordinary makes can be secured upon Beckton terms at about £11 7s. 6d. In Hull, £11 7s. 6d. is now asked for the best makes; and in Liverpool, £11 8s. 9d. is reported to have been paid. In Leith, the market is nominally £11 10s. for prompt, and £12 for forward. There is, however, little stuff offering for the former, and dealers refuse to pay the latter price.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a continuance of the quietness in the steam coal trade, with lower prices, more especially when the delivery is forward. For best Northumbrian steams, from 11s. 3d. to 11s. 6d. per ton f.o.b. is quoted, according to period of sale. For second-class steams, about 10s. 3d. to 11s. is the price; and for steam smalls there is a better demand—the current quotation being from 5s. to 6s. Production at the collieries is steady, and so far the coal is well taken up; but sales ahead are not so freely made. In the gas coal trade, there is a growing consumption locally, and the shipments on contract seem to be heavy. Best gas coals have been well sold, and now are readily taken up; but other qualities appear to be abundant. Current prices for Durham gas coals are quoted from about 9s. 6d. to 11s. per ton f.o.b., according to quality; and for "Wear specials" up to 11s. 9d. is asked. There are not many new contracts in course of negotiation at present; but sales of moderate quantities over the winter are reported at equal to 10s. 1½d. per ton f.o.b. There is now little doubt that the tendency of prices of gas coals is downwards for forward delivery; but for best kinds the winter values may be maintained. In coke, the market is steady; and good gas coke, though more plentiful, is from 17s. to 18s. per ton f.o.b.

Scotch Coal Trade.

The market has been quieter. Shipping orders have fallen off; and the home trade has not shown any improvement. Prices have, in consequence, become a little easier. The quotations are: Ell, 10s. 6d. to 11s. 6d. per ton f.o.b. Glasgow; splint, 11s. to 11s. 3d.; steam, 10s. 3d. to 10s. 6d. The shipments for the week amounted to 336,789 tons—an increase of 18,271 tons upon the previous week, and of 40,382 tons upon the same week of last year. For the year to date, the total shipments have been 11,662,511 tons—a decrease upon the corresponding period of 214,353 tons.

"A. B. C."

Gas Fires.

"WARMTH in the HOME."

One of many Illustrations in our up-to-date Booklet, "Warmth in the Home." Undoubtedly the most handsome, educational production ever offered for general distribution. It deals with every phase of Gas for Domestic Heating. We are receiving ***daily*** many requests for supplies, and our second edition is now in course of preparation. We welcome your early application.

RICHMOND GAS STOVE & METER CO., LTD.

Advertisement of the RICHMOND GAS STOVE & METER CO., LTD.
London Offices and Show-Rooms: 132, Queen Victoria Street, E.C. General Offices and Works: Warrington.

Charge for Water in the City of London.

At the public meeting which is to be held at the Mansion House to-morrow, under the presidency of the Lord Mayor, to protest against the charges made by the Metropolitan Water Board, three resolutions will be submitted. The meeting will be asked: (1) To deprecate the action of the Board in enforcing at the outset their maximum statutory powers, and to protest against the largely increased charges for water in business premises on the basis of rateable value, having regard to the relatively small consumption of water on the premises when supplied otherwise than by meter. (2) To send copies of the resolution to the President of the Local Government Board, the Metropolitan Water Board, the Corporation of the City of London, the London County Council, and the Metropolitan Borough Councils. (3) To urge upon the Corporation of the City of London, the London County Council, and the Metropolitan Borough Councils the importance of instructing their representatives on the Water Board to support a reduction of the present charges, or an increase in the rebate allowable under section 9 of the Board's Charges Act of 1907; thus affording some measure of relief to the consumers. The Lord Mayor will be supported by an influential assembly.

Coventry Gas and Electricity Departments.

The Coventry Corporation have now under consideration the question whether it would not be well, in the interests of the ratepayers, to place the Gas and Electricity Departments under one control. The matter has only reached the Committee stage so far as actual debate is concerned; and a recommendation has yet to be made. At the meeting of the City Council last Tuesday, Mr. Pridmore, who is the Vice-Chairman of the Electric Light Committee, stated that the question of making a definite appointment of Manager of the electricity undertaking, in succession to Mr. J. A. Jeckell, had been deferred for six months, in order to afford an opportunity for further considering this point. The fact was that in the gas and electricity undertakings they had two departments competing with each other; and it was a question whether it would not be an advantage to co-ordinate the two Committees. It had been suggested by one member that it was not desirable to eliminate competition from the concerns, as the ratepayers might suffer; but he did not think this was at all likely, as the reputation of the Manager would be bound up with both. The main difficulty, however, was that they had two entirely separate branches in gas and electrical engineering, and it did not follow that a good gas engineer was necessarily a good electric engineer, or *vice versâ*. Still, he was of opinion that in the Electricity Department at the present time they had about as much work and responsibility as they could manage; and if the matter was to be seriously considered, he suggested that they should appoint a separate Committee who could take evidence from any members of either the Gas or the Electric Light Committees who cared to furnish it.

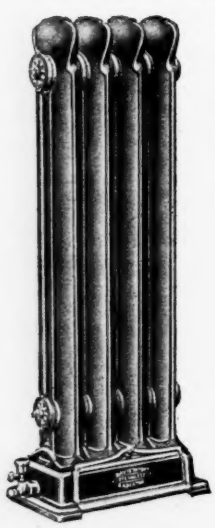
Gas Profits at Keighley.

The report on the working of the gas undertaking which was submitted at a recent meeting of the Keighley Town Council showed that the profits had been £142,550; paid in reduction of debt, £58,024; in hand for workmen's dwellings, £2363; leaving the present debt at £81,162, or, allowing for various balances in hand, only £39,887. Receipts on revenue during the year ended June 30 had been £49,134, and the expenditure £33,750, leaving a gross profit of £15,384. After providing for interest, sinking fund, renewals, &c., which absorbed £7930, there was left a balance of £7454. After giving £41 to the fire brigade and adding £1513 to the floating balance, there remained £5900, which it was proposed to hand over in relief of the rates. In moving the adoption of the report, Mr. Harrison said that altogether £3132 more had been paid for coal; but the greater revenue from gas and coke had reduced the increased cost to £1051. On the other hand, the profits were £1423 more than had been estimated. The balance carried over, it was thought, would safeguard the position against any fear of reduction during the next two years in the amount handed over in relief of the rates. As to gas sold, the year had been the best since the erection of the gas-works. The works were in good order, and capable, with very little increase in capital expenditure, of producing 50 per cent. more gas than at present.

Floods in the Rhymney Valley.—Serious floods occurred in South Wales last week, and caused widespread inconvenience and damage, as well as, unhappily, the loss of at least one life. The bye-product plant of the Powell Duffryn Colliery, which is situate on both banks of the river at Bargoed, was inundated. The vicinity of the colliery was enveloped in clouds of smoke and steam issuing from the coke-ovens, which were unapproachable, owing to the depth of water and the heat. The Bargoed Post Office was flooded; and the gas-works near by also, it is stated, suffered. Pontlottyn was plunged in darkness, owing to the flood interfering with the gas supply.

Neath Gas-Works Extensions.—An inquiry on behalf of the Local Government Board was recently held at Neath, by Mr. R. H. Bicknell, regarding an application by the Town Council for sanction to borrow £10,000 for the purposes of the gas undertaking. It was stated by the Town Clerk (Mr. E. C. Curtis) that a sum of £3500 was required for the purpose of extending the retort-house and providing certain machinery and retort-settings, in order to meet the increasing consumption of gas in the winter months. Then £6500 was needed to meet ordinary expenditure in the way of extensions to mains and the purchase of meters and cooking stoves. Alderman Hopkin Moran, the Chairman of the Gas Committee, said the whole matter had been before the Committee; and upon their report, the Council unanimously decided to proceed with the work. For the last three years the gas undertaking had relieved the rates to the extent of £3000.

Sound Reasons for adopting Davis's Steamless Radiator. 2



It is a scientifically constructed Apparatus wherein the Heat is evenly distributed over the whole surface of the Apparatus WITHOUT THE AID OF HOT WATER OR STEAM.

It gives uniform Heat, and is entirely free from all complications such as Valves, Water Gauges, and other incidentals to Steam-Heated Apparatus.

It is cheaper to install than ANY FORM of Steam or Hot-Water Radiator, and is THE MOST ECONOMICAL METHOD of Heating Churches and other Public Buildings, Shops, Factories, and the like.

The Davis Gas Stove Co.,

CAMBERWELL, LONDON, S.E. Ltd.

Water Supply Scheme for Wotton-under-Edge.—In the Town Hall, Wotton-under-Edge, Major C. E. Norton, R.E., Local Government Board Inspector, recently held a public inquiry into an application by the Dursley Rural District Council for sanction to borrow £2700 for the purposes of water supply for the town of Wotton-under-Edge. Mr. H. J. Weaver (the Engineer for the scheme) gave some particulars as to the existing water supply, and, in explaining the proposed supplementary scheme, stated that the springs which it was proposed to collect were situated at Coombe Valley, and had a regular yield of 74,000 gallons per 24 hours. In the case of a second spring, a weir had been put in; and this was also found to give a satisfactory yield.

Afforestation Work of the Leeds Corporation.—In the House of Commons, on Monday last week, Mr. Fell asked the President of the Local Government Board if any report or statement could be laid before the House giving the result of the afforestation experiment at Leeds, so far as it has gone, with the number of unemployed engaged, the acreage and number of trees planted, and the cost of the experiment. In reply, Mr. Burns stated that the Water-Works Engineer of the Leeds Corporation (Mr. C. G. Henzell) had made a report on the result of three seasons' afforestation work, and that the totals were as follows: Number of unemployed engaged, 476; area planted, 514 acres; number of trees planted, 1,514,300; cost of the experiment, including £1043 spent in 1904-5 for barracks, £7194.

Bagshot Water Supply.—The inhabitants of Bagshot have hitherto been in the unique position of having a sufficient supply of water laid on from mains to their houses without having to pay any rates, other than a very small charge consequent upon keeping the pipes in order. The water is obtained from springs on an estate situated in the parish; the height from which the supply is obtained being sufficient to obviate the necessity of pumping. As complaints have been made in regard to the purity of the water, the mains of the South-West Suburban Water Company are to be extended to Bagshot, and the old system is to be dispensed with. For the first few years the charges for the service will mean a heavy addition to the rates; otherwise the inhabitants are recognizing the benefits that the new arrangement will bring with its adoption.

Theft of Money from Aberavon Gas-Works.—It was reported by the Gas Committee at last week's meeting of the Aberavon Town Council that nothing had been discovered in connection with a theft of £10 6s. 9d. in coppers from the old gas-works. At the Committee meeting, Alderman James proposed, and Mr. Percy Jacob seconded, that the Gas Manager (Mr. A. J. Bond) be asked to refund the amount that had been stolen; it being stated that he was not prepared to do so. An amendment that the Manager be allowed a fortnight's grace to consider the matter was carried by six votes to four. In the Council, Alderman James again moved his amendment that they call upon Mr. Bond to refund the money. Alderman Smith seconded, and said they had asked previous officials to refund money. On a vote being taken, the amendment was defeated by seven votes to five.

The Injurious Steam-Roller.—A steam-roller, during its operation in Church Street, Conway, broke a gas-main. The gas in time percolated through the ground into the adjoining High Street, where subsequently an explosion lifted the pavement for a considerable distance, and caused some damage in adjoining houses. Fortunately, however, nobody was injured. Where or how the gas ignited is a mystery.

Colonial Gas Association, Limited.—At the annual general meeting of the Association on the 3rd prox., the Directors will report an average increase of more than 11 per cent. in the consumption of gas in the year ending the 30th of June last. The benefit derived from this improvement was, however, more than counterbalanced by the high price of coal, increased wages, and exceptionally heavy expenditure for repairs and maintenance of mains and services. The accounts accompanying the report show a profit of £6282; and a sum of £3886 is available for distribution. An interim dividend at the rate of 4 per cent. per annum was paid in April; and the Directors recommend a final dividend at the rate of 6 per cent., free of income-tax (making 5 per cent. for the year), and the addition of £400 to the reserve.

Deaths by Coal Gas in Kensington.—Henry White, aged 70, an out-of-work plumber, committed suicide by covering his face and inhaling coal gas from piping which he had pulled away from the wall. The Coroner's Jury returned a verdict in accordance with the evidence. At the same Court, an inquiry was held regarding the death of Robert Holden, aged 46, a tailor, who was also poisoned by coal gas. Deceased's widow said he had been worried by business affairs, and had given way to drink. A lodger stated that, finding the house full of gas, she went to investigate the cause, and in one room found a burner turned on. The window was open; but the fireplace register was down, and the door closed, though not blocked up. Deceased was lying on a couch dead. In this case, the Jury returned an open verdict.

Swansea Corporation and their Engineer.—There has lately been some friction between the Swansea Corporation and the Borough Engineer (Mr. R. H. Wyrill); and the matter was discussed by the Council last week. The complaint was that the Engineer had undertaken private work without the authority of the Water Committee, and that there had been unreasonable delay in carrying out certain drainage work. A Sub-Committee recommended that Mr. Wyrill be asked to resign; but this the Water and Sewers Committee regarded as too drastic, and declined to accept. When the Committee's minutes came before the Council, it was moved that the Sub-Committee's recommendation be accepted; but after a long discussion (in the course of which free acknowledgment was made of Mr. Wyrill's great services in connection with the city's water undertaking), and a denial by the Engineer of the truth of the allegations brought against him, the proposal was defeated. A resolution was, however, passed to the effect that, in view of the fact that Mr. Wyrill did, in violation of his contract with the Corporation, accept outside engagements, he be requested to pay the amounts so received into the coffers of the Corporation; and that if in future Mr. Wyrill undertook work from other employers, the Council would have no alternative but to dispense with his services.

THE "ST. ANDREW."

Double Column.
Plain Design. . .

A Deluge of Orders!

The demand, as we anticipated, for the

"ST. ANDREW"

Gas-Heated

STEAM RADIATOR

has, in spite of the prevailing mild weather, already enormously exceeded all past records, and our Works are fully occupied with the continuous stream of orders, which is daily pouring in.

JOHN WRIGHT & CO.,
ESSEX WORKS,
BIRMINGHAM.

No. 181.

Coal Stack on Fire.—A stack of about 800 tons of coal at the Truro Gas-Works was discovered to be on fire last week. Under the direction of the Engineer and Manager of the works (Mr. S. J. Ingram) the stack was pulled down, with the result that after the removal of about half of it, the seat of the fire was reached, and the outbreak extinguished. The loss is covered by insurance.

Hendon Public Lighting.—At the last meeting of the Hendon Urban District Council, it was reported that the Hendon Electric Supply Company, Limited, had offered to light the public lamps throughout the district by electricity, and the Works Committee intend to consider the matter shortly before the expiration of the North Middlesex Gas Company's contract. The Company are to be asked for competitive terms.

Proposed Gas-Works Purchase at Cannock.—At a special meeting of the Cannock Urban District Council last Tuesday, a letter from the Gas Company was read stating that the Directors had considered a communication from the Council with respect to the purchase of the undertaking; but they were not desirous of selling. The matter was considered in private; and it was decided to call a meeting of the General Purposes Committee to go further into the question.

New Issues of Gas and Water Capital.—It will be seen from announcements which appear elsewhere that Messrs. A. & W. Richards will offer for sale at the Mart, Tokenhouse Yard, E.C., next Tuesday, by order of Directors, £12,000 of 4 per cent. perpetual debenture stock of the Ilford Gas Company, and a like amount in 5 per cent. maximum £10 shares in the Southend Water Company. The latter rank equally with the Company's existing similar shares, the dividend on which for the year ending Dec. 31, 1907, was 4½ per cent.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards sold, by order of the Directors, new issues of stock of the Southend Gas Company and the Great Yarmouth Water Company. Ordinary "B" stock to the amount of £13,500 of the first-named Company fetched from £107 5s. to £108 10s. per £100; and some 4 per cent. perpetual debenture stock, from par to £100 10s. A new issue of £4000 of new ordinary stock of the Great Yarmouth Water Company realized from £95 to £99 per £100 of stock; and 4 per cent. perpetual debenture stock, £104 10s. and £105. On the same occasion, Messrs. Richards sold for private owners £500 of 4½ per cent. preference gas stock in the Swanage Gas and Water Company at £101 per £100; and 400 5 per cent. preference shares (£5) in the High Wycombe Gas Company at from £5 1s. 3d. to £5 5s. each. Mr. Arthur Ayres offered for sale, at the Queen's Hotel, Reading, last Tuesday, £2215 of ordinary stock and ten £10 5 per cent. preference shares in the Reading Gas Company. The whole of the lots were sold at very satisfactory prices. At the Royal Hotel, Slough, last week, Messrs. Buckland and Sons sold 17 original and 14 fully-paid new ordinary shares of £10 each in the Slough Gas Company. The former realized from £22 5s. to £22 17s. 6d., and the latter £17 2s. 6d., apiece.

Automatic Gas Lighting at Ascot.—The Ascot District Gas and Electricity Company have recently fixed Horstmann automatic gas-controllers to the street-lamps in the neigbourhood of Ascot.

The Awards at the Franco-British Exhibition.—We note that in the list of awards at the Franco-British Exhibition published in the "JOURNAL" last week, a diploma for honourable mention, which in the official list was given to the "Scott-Snell Gas Company," was inadvertently entered as having been awarded to the Scott-Snell Self-Intensifying Gas-Lamp Company instead of to the Scott-Snell Vacuum Gas Compressor, Limited.

Gale-Defying Gas-Burners.—Under this heading, the "Liverpool Courier" last Wednesday remarked: "On account of the high winds prevalent at times at Pensarn, the incandescent system of gas lighting has proved a failure, owing to the lights being blown out. The Abergele Council have now tried self-intensifying burners, which have triumphed against the most formidable north-westerly gales. It is intended to light the whole district with these burners."

At the meeting of the Pontypridd District Council last Tuesday, it was decided to join the Glamorgan Water Board.

The Hatfield Broad Oak Water Company, Limited, has been registered with a capital of £5000, in £5 shares, for the object indicated in the title.

In many of the Sussex seaside towns it has been found that the consumption of gas in the month of August exceeds the winter demands, owing to the introduction of the penny-in-the-slot meters.

Sir Frederick Mappin, who until quite recently was the Chairman of the Sheffield Gas Company, was so touched at the sight of the unemployed while being wheeled through the streets of Sheffield in a bath-chair one day last week that he sent a cheque for £250 to the Lord Mayor for distribution—a relief fund having been started in the borough.

We learn that Messrs. J. Firth Blakeley and Co. have the following extensions on hand: A new gasholder, with cupping, for Axminster, and a new single-lift holder, 50 feet in diameter, with cupping, for Thornton, near Liverpool, to be erected under the supervision of Mr. Isaac Carr, of Widnes; also 8-inch condensers. They are overhauling the Market Deeping Gas-Works, including the fixing of a new foul main, condensers, and Livesey washer, gas engine and exhauster, tower scrubber, and increasing the size of the yard connections. At the Crowle Gas-Works, near Doncaster, they are completing a new tower scrubber and condenser, alterations to purifiers, including two four-way valves, station governor, coupling-up meter, and increasing the yard connections, to the specification of Mr. Robert Watson, of Doncaster. They have finished new 10-inch annular condensers and 6 ft. by 50 ft. tower scrubbers, with spiral staircase, &c., at Abingdon; and they are erecting a cast-iron tank and holder for Goudhurst.

(Picture Post Card Artistically produced in Three Colours.

May we send you a Supply for Distribution among your Consumers?

THE PARKINSON STOVE CO., LTD.,

BIRMINGHAM.

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COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

"ILLUMINATING TRUTHS."

LEAFLETS FOR DISTRIBUTION.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it.
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."
No. 7.—"The Osram Lamp: Fiction and Fact.

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Ayr Gas Company. Applications by Nov. 30.
FOREMAN. Ulverston Gas-Works.
DRAUGHTSMAN. No. 5005.

Situations Wanted.

CHEMICAL PLUMBER AND LEAD BURNER. Davies, Shepherd's Bush.
REPRESENTATIVE. No. 5009.
REPRESENTATIVE. No. 5010.
REPRESENTATIVE OR ASSISTANT. No. 5008.
RETORT SETTER, &c. No. 5012.

Capital Wanted.

GAS-WORKS PURCHASING SYNDICATE. No. 5006.

Meeting.

CEARA GAS COMPANY. London Offices. Nov. 6. One o'clock.

Plant (Second-Hand) for Sale.

PURIFIERS, STATION METER, &c. Seaham Harbour Gas Company.
RETORT IRON WORK, &c. Swansea Gaslight Company.

Stocks and Shares.

ALDERSHOT GAS AND WATER COMPANY. Nov. 17.
ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY. Nov. 17.
ILFORD GAS COMPANY. Nov. 3.
NORTHFLEET AND GREENHITHE GAS COMPANY.
SOUTHEND WATER COMPANY. Nov. 3.

TENDERS FOR

Acetylene or Petrol Gas Plant. No. 5011.

Fire-Clay Goods.

SHEFFIELD GASLIGHT COMPANY. Tenders by Nov. 2.

Pipes, &c.

BROADSTAIRS GAS COMPANY. Tenders by Nov. 2.
ISLE OF THANET GAS COMPANY. Tenders by Nov. 5.

Pitch.

No. 5013. Tenders by Nov. 5.

Sulphuric Acid.

BANGOR GAS DEPARTMENT. Tenders by Nov. 14.

Tar.

BANGOR GAS DEPARTMENT. Tenders by Nov. 14.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 251.

Issue.	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 15	10	Alliance & Dublin 10 p.c.	17½—18½	−1	5 8 1
268,324	10	,,	7	Do. 7 p.c.	12½—13½*	..	5 3 8
310,000	Stk.	July 15	4	Do. 4 p.c. Deb.	99—102	..	3 18 5
200,000	5	May 29	6½	Bombay, Ltd.	5⅞—6¼	..	5 4 0
40,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
50,000	10	Aug. 27	14	Bourne-mouth Gas and Water	B 7 p.c.	..	4 16 6
51,810	10	,,	7		16½—16⅝	..	4 3 7
53,200	10	,,	6		Pref. 6 p.c. 15—16	..	3 15 0
350,000	Stk.	Aug. 13	12½	Brentford Consolidated	244—249	..	5 0 5
320,000	,,	,,	9½	Do. New	183—188	..	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	June 12	4	Do. 4 p.c. Deb.	100—105	..	3 16 2
220,000	Stk.	Sep. 11	10⅝	Brighton & Hove Orig.	205—210	..	5 2 4
246,320	,,	,,	7¼	Do. A. Ord. Stk.	150—155	..	5 0 0
460,000	20	Oct. 15	10	British	41—42*	..	4 15 3
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.	113—116	..	5 3 5
165,700	,,	,,	4½	Do. do. 3½ p.c.	84—86	..	5 4 8
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd.	11—11⅛*	..	6 1 9
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 15	7½	Cagliari, Ltd.	24½—25½	..	5 13 9
100,000	10	—	—	Cape Town & Dis., Ltd.	4—6	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	5—7	..	6 8 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	78—83	..	5 8 5
157,150	Stk.	Aug. 13	5	Chester 5 p.c. Ord.	108½—110½	..	4 12 7
1,493,280	Stk.	Aug. 27	5 7/10	Commercial 4 p.c Stk.	106—111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do.	103—106	..	4 14 4
475,000	,,	June 26	3	Do. 3 p.c. Deb. Stk.	82—84	..	3 11 5
800,000	Stk.	June 12	6½	Continental Union, Ltd.	108—113	..	5 15 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
460,170	Stk.	—	5	Derby Con. Stk.	122—124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
148,995	,,	Sep. 30	5	East Hull 5 p.c. Ord.	97—100	..	5 0 0
486,090	10	July 15	12	European, Ltd.	23½—24½	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	17—18	..	5 2 10
15,182,590	Stk.	Aug. 13	4/10/8	Gas-light and Coke	4 p.c. Ord.	..	4 12 6
2,600,000	,,	,,	3½		3½ p.c. max.	..	3 18 8
3,799,735	,,	,,	4		4 p.c. Con. Pref.	..	3 14 9
4,193,975	,,	June 12	3		3 p.c. Con. Deb.	..	3 8 11
258,740	Stk.	Sep. 11	4½	Hastings & St. L. 3½ p.c.	93—93	..	4 16 11
82,500	,,	,,	6¼	Do. do. 5 p.c.	112—115	..	5 8 8
70,000	10	Oct 15	11	Hongkong & China, Ltd.	17⅛—18⅜*	..	5 18 11
123,500	Stk.	Sep. 11	6½	Ilford "A" and "C"	128—133	..	4 17 9
65,780	,,	,,	5	Do. "B"	100—105	..	4 15 3
51,000	,,	June 26	4	Do. 4 p.c. deb.	100—105	..	3 16 2
4,940,000	Stk.	May 14	8	Imperial Continental	183—186	+1½	4 6 0
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	116—120	..	5 0 0

Issue	Share.	When ex. Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
561,000	Stk.	Aug. 27	10	Liverpool United A	227—229	..	4 7 4
718,100	,,	,,	7	Do. B	166—168	..	4 3 4
306,083	,,	June 26	4	Do. Deb. Stk.	104—106	..	3 15 6
75,000	5	June 26	6	Malta & Medn., Ltd.	4¼—4⅝	..	6 6 4
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	May 29	3½	Monte Video, Ltd.	11½—12½	..	5 12 0
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G'tesh'd Con.	108—109	+⅛	4 4 10
418,460	Stk.	June 26	3½	Do. 3½ p.c. Deb.	90—92	..	3 16 1
15,000	10	Aug. 27	10	North Middlesex 10 p.c.	19½—20½	..	4 17 6
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	140—143	..	5 11 11
60,000	5	Sept. 30	8	Ottoman, Ltd.	6—6½*	..	6 3 1
31,800	53	Aug. 27	13	Portsea Island A	135—140	..	4 18 6
60,000	50	,,	13	Do. B	130—135	..	4 16 4
100,000	50	,,	12	Do. C	120—125	..	4 16 0
114,800	50	,,	10	Do. D and E	100—110	..	4 10 11
398,490	5	Apl. 29	7	Primitiva Ord.	5⅝—6⅛	..	5 12 0
796,980	5	July 30	5	Do. 5 p.c. Pref.	4⅞—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	95—97	−2	4 2 6
1,000,000	10	Oct. 15	8	River Plate Ord.	13—13⅜*	..	5 18 6
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
250,000	10	Sept. 30	8	San Paulo, Ltd.	14—14½	..	5 10 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Sept. 11	10	Sheffield A	240—242	+1	4 2 8
209,984	,,	,,	10	Do. B	240—242	+1	4 2 8
523,500	,,	,,	10	Do. C	240—242	+2	4 2 8
70,000	10	May 29	10	South African	13½—14½	..	6 17 11
6,429,895	Stk.	Aug. 13	5/6/8	South Met., 4 p.c. Ord.	120—122	..	4 7 4
1,895,445	,,	July 15	3	Do. 3 p.c. Deb.	84—86	..	3 9 9
209,820	Stk	Aug. 31	8	South Shields Con. Stk.	152—154	..	5 3 10
605,000	Stk.	Aug. 13	5/6/8	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 10 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
117,058	,,	July 15	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 14	5	Southampton Ord.	108—113	..	4 8 6
120,000	Stk.	Aug. 13	6¼	Tottenham and Edmonton	A 5 p.c.	..	4 18 6
398,940	,,	,,	5¼		B 3½ p.c.	..	4 17 3
149,470	,,	June 26	4		4 p.c. Deb.	..	3 16 2
182,380	10	June 12	8	Tuscan, Ltd.	10—10½	..	7 12 4
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
193,742	Stk.	Aug. 27	5	Tynemouth 5 p.c. max.	104—106	..	4 14 4
855,636	Stk.	Aug. 27	6⅜	Wandsworth and Putney	B 3⅜ p.c.	..	5 0 0
79,416	,,	June 26	3		3 p.c. Deb. Stk.	..	3 16 11
845,872	,,	Aug. 27	5⅜	West Ham 5 p.c. Ord.	103—106	+1	4 16 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—123	..	4 1 3
228,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.	100—105	..	3 16 2

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